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Technical Support to the South Coast Air Quality Management District Toxic Chemical Accidental Air Releases

Radian Corp., Austin, TX

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TECHNICAL SUPPORT TO THE
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
TOXIC CHEMICAL ACCIDENTAL AIR RELEASES

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ABSTRACT

The South Coast Air Quality Management District requested technical support toward developing a regulatory approach for controlling potential accidental air releases of toxic chemicals. This report provides some of the technical input and describes other support efforts. These efforts included preparation of the technical contents of an example draft rule applicable to facilities using or storing seven specific toxic chemicals and technical reference manuals concerning hazards and their control in such facilities.

ACKNOWLEDGEMENTS

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SECTION 1

INTRODUCTION

1.1 INITIATION AND PURPOSE OF THE STUDY

Concern for accidental toxic chemical air releases, and especially a Bhopal type incident, has prompted considerable interest in the prevention and mitigation of such releases. In January of 1985, the Governing Board of the South Coast Air Quality Management District directed a study to be undertaken concerning prevention and preparedness for a large toxic chemical air release in the South Coast Air Basin of Southern California. The two main objectives of the study were to assess: 1) the ability of the chemical industry to avoid a chemical disaster of Bhopal proportions, and 2) the ability of the four counties comprising the district (Los Angeles, Orange, San Bernandino, and Riverside) to respond effectively if such a disaster occurred. The resultant study was the South Coast Air Basin Accidental Toxic Air Emissions Study, issued in September, 1985 (Exhibit A).

As a result of this study, the SCAQMD decided to develop a rule for facilities that use or store any of several toxic chemicals above certain quantities. The purpose of the rule would be to ensure that appropriate technical, administrative, and operational controls existed at designated facilities to minimize the potential for accidental toxic chemical air releases. SCAQMD approached Region 9 of the U.S. Environmental Protection Agency (EPA) for technical support.

Region 9 decided to provide technical support to SCAQMD under Section 105 State Grant Funds for the development of their rule. In their proposal, the SCAQMD identified a task to develop "implementation guidelines" which appeared to be similar to a series of Prevention Reference Manuals (PRM) that had been proposed for development by the U.S. EPA. EPA felt that support to the States in demonstration projects, such as a Region 6 inspection project and Region 2's interest in an inspector's training course, would help EPA to increase its own expertise. The EPA Office of Research and Development (ORD) met with Region 9 and SCAQMD and agreed to proceed with a technical support project to SCAQMD with funding from Region 9 for technical input into the Rule and the PRMs and from ORD for the PRMs. The Air and Energy Engineering Research Laboratory (AEERL) was designated as the ORD project monitor, and subsequently contracted with Radian Corporation to do the work on the PRMs and simultaneously provide technical information to support the rule development. SCAQMD decided that the rule would be similar in format and structure to their existing air rules, an example of which is shown in Exhibit B. SCAQMD also felt that the PRMs would be the type of technical support the rule needed, both as a guide to industry and to the regulators and inspectors in taking measures to reduce the probability and severity of accidental air releases of toxic chemicals. A primary technical approach favored by the SCAQMD for release prevention was redundancy.

1.2 ROLES OF U.S. EPA, RADIAN CORPORATION, AND THE SCAQMD

Specific roles were clearly defined for the U.S. EPA, Radian Corporation, and the SCAQMD in this effort:

- EPA was to provide technical assistance in areas identified by the SCAQMD where the SCAQMD felt they needed support. This technical information was to be supplied to the SCAQMD in the form of a preliminary draft of a rule, as well as various PRMs when they were available.

- The SCAQMD was to write a final draft of the rule, conduct reviews, and follow through on their usual rulemaking procedures. At that stage further use of EPA input is optional.

- Radian Corporation was charged with preparing the PRMs as well as providing an example draft of how a rule might be configured based on the technical requirements of release prevention through the technical information developed in the PRMs.

These three groups were to work together with a Technical Advisory Group (TAG) to meet the program's objectives. The TAG was to provide technical expertise and industrial experience as well as assure the technical quality of EPA's input to SCAQMD. Members represented industry, the States, associations, and representatives from other parts of EPA.

A fundamental principle of this program is that the rule being developed is at the initiative and overall direction of the SCAQMD and does not represent any official policy of the EPA and is not to be perceived as EPA recommendations. There is no intent that the example draft rule developed in this program is necessarily to be used by others. Reportable quantities of chemicals in the draft rule have no relation to other requirements such as EPA reportable quantities, and nothing in the rule is to take the place of any existing or future EPA requirements, should there be any.

1.3 BACKGROUND WORK BY THE SCAQMD

In conjunction with SCAQMD study mentioned previously, a formal survey was conducted by the SCAQMD of facilities in the District. This survey identified facilities and their inventories of specific chemicals on the SCAQMD list of chemicals of concern which was presented in the SCAQMD study. A summary of the findings of the survey in terms of types of facilities and reported inventories is presented in Exhibit C for seven specific chemicals that, as a result of the study and survey, the SCAQMD decided might be subject to the rule. These seven chemicals are:

- chlorine (CAS NO. 7782-50-5),

- hydrogen fluoride (CAS No. 7664-39-3),
- hydrogen cyanide (CAS No. 74-90-8),
- ammonia (CAS No. 7664-41-7),
- carbon tetrachloride (CAS No. 56-23-5),
- sulfur dioxide (CAS No. 7446-09-5), and
- chloropicrin (CAS No. 76-06-2).

The technical effort described in the next section focused on these seven chemicals.

SCAQMD identified its requrements in the following general areas:

- format for the rule,
- the specific chemicals covered,
- types of facilities,
- procedures,
  - applicability,
  - registration,
  - hazard identification,
  - control plan,
  - risk reduction plan,
  - recordkeeping,
- emphasis on redundancy or backup control systems, and
- technical aids for hazard identification and evaluation for permitting and inspections.

SECTION 2
DESCRIPTION OF TECHNICAL SUPPORT EFFORT

2.1 MAIN ELEMENTS

2.1.1 Planning Meetings

The Contractor and EPA met several times with the SCAQMD to plan the overall approach for providing technical support to the development of the rule and to define its scope. These meetings discussed issues such as applicability and the definition of a designated facility, defining threshold quantities to trigger applicability, and the technical areas, which would be addressed by the rule, within a designated facility. The meetings also defined the mechanisms for transmitting information between the Contractor, EPA, the SCAQMD, and the TAG. Some meetings were also held with the TAG for review and comment on the program's progress.

2.1.2 Preparation of the Prevention Reference Manuals

After initiation of the technical effort, the next step was gathering technical information on chemical release hazards and their controls for industrial facilities of the type handling the seven designated chemicals in the SCAQMD. This information was to be incorporated into the PRMs that would provide technical guidance for both regulatory and industrial personnel on hazard identification, evaluation, and remediation. This information would be the basis for specifying appropriate control equipment, procedures, and practices that could be incorporated into a rule. An overview of the three manuals is shown in Figure 2-1. The structure and contents of the PRMs are discussed in more detail in Section 2.3 of this report.

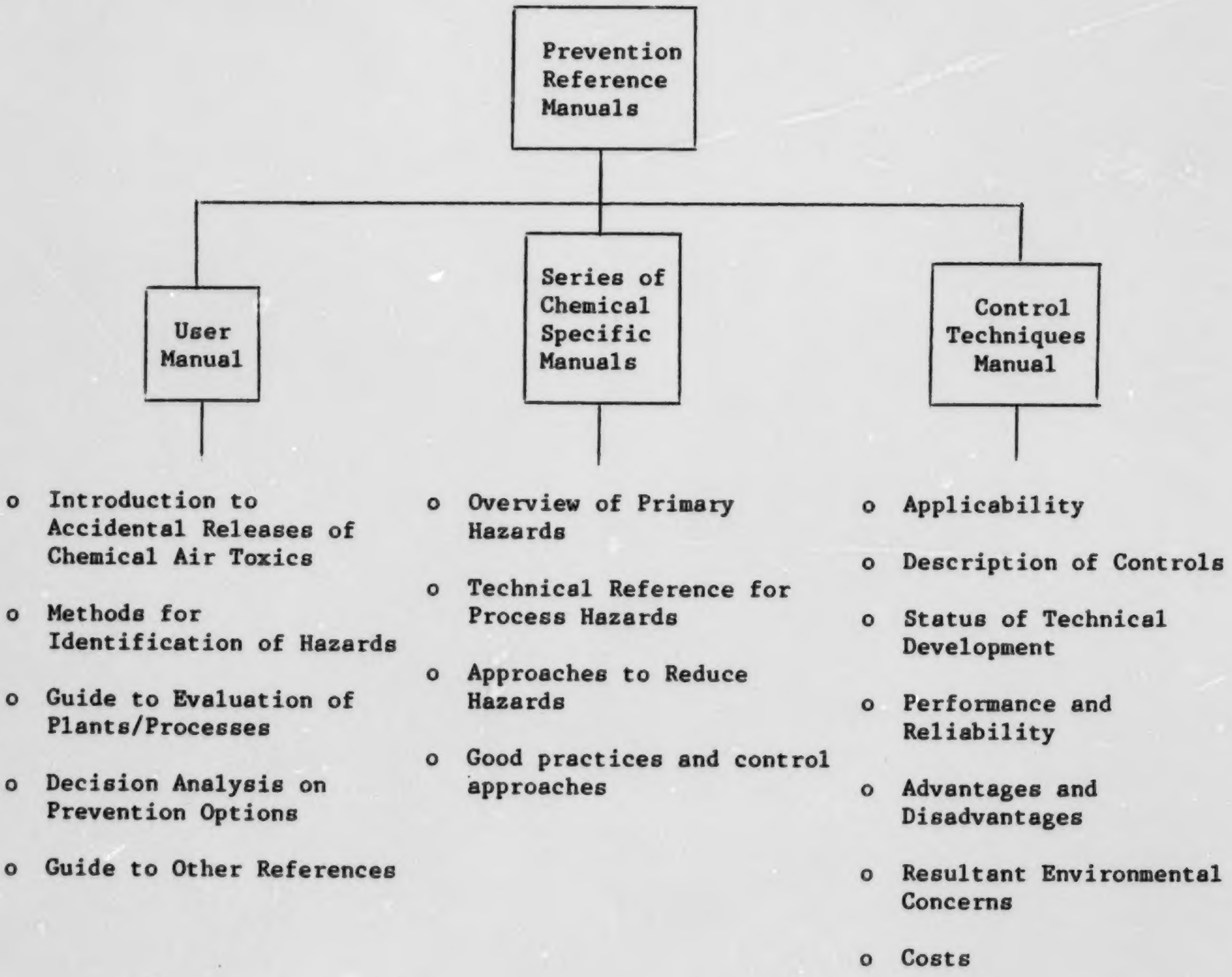
Prevention Reference Manuals
User Manual
Series of Chemical Specific Manuals
Control Techniques Manual
o Introduction to Accidental Releases of Chemical Air Toxics
o Methods for Identification of Hazards
o Guide to Evaluation of Plants/Processes
o Decision Analysis on Prevention Options
o Guide to Other References
o Overview of Primary Hazards
o Technical Reference for Process Hazards
o Approaches to Reduce Hazards
o Good practices and control approaches
o Applicability
o Description of Controls
o Status of Technical Development
o Performance and Reliability
o Advantages and Disadvantages
o Resultant Environmental Concerns
o Costs

Figure 2-1. Overview of prevention reference manuals.

2.1.3 Preparation of a Draft Rule

In addition to compiling and analyzing information for the SCAQMD, the technical support effort also involved preparation of an example draft rule to illustrate how the technical information developed in the PRM effort could be applied in a regulatory context specific to the SCAQMD. This draft could be used by the SCAQMD to develop a complete rule for actual application in the District. Various versions of the draft rule were prepared, reviewed in meetings between the Contractor, EPA, SCAQMD, and the TAG, and revised into the form outlined in Section 3.1 and presented in Exhibit D of this report.

2.2 SCAQMD INPUTS

Specific technical input to support this effort was obtained from the SCAQMD. These technical inputs included:

- Results of the SCAQMD background study discussed earlier (Exhibit A),
- The scope, format, overall structure used for other air rules developed by the district, (Exhibit B),
- Results of the SCAQMD facilities survey conducted in conjunction with the study (Exhibit C), and
- The scope and constraints of an accidental release rule based on the District's jurisdiction (e.g., highway transportation is outside the jurisdiction).

Basic elements to be addressed by the rule included:

- applicability,
- administrative requirements, and
- technical requirements.

These form the basis of the outline presented in Section 3.1 of this report.

2.3 PREVENTION REFERENCE MANUALS

Preparation of the Prevention Reference Manuals was a key component of the technical effort. The PRMs consisted of three basic document efforts:

- Prevention Reference Manual - User's Guide,
- Prevention Reference Manuals - Chemical Specific Information, and
- Prevention Reference Manual - Control Technologies

The purpose of the User's Guide is to provide an introduction to the overall area of accidental chemical releases, provide technical reference methods for identification of hazards and general evaluation of control techniques, and serve as a guide to available information in more detailed manuals and the general technical literature. The scope of the User's Guide is to provide historical background and an overview of accidental chemical releases, an introduction to formal methods of hazard identification and evaluation, an overview of the principles of control, and a guide for inspections of a chemical process facility.

Individual chemical specific information manuals are being prepared for each of the seven chemicals listed in Section 1. The purpose of these manuals is to provide guidance for a process hazard review of facilities using or storing these chemicals in the SCAQMD. The manuals are to provide sufficient summary information to enable the reader to identify primary hazards and corresponding control technologies specific to each chemical as it is used and stored in the SCAQMD.

The third document is the Prevention Reference Manual - Control Technologies. This two-volume manual discusses specific technologies for the prevention and mitigation of accidental chemical releases. The approach used addresses two fundamental elements of risk reduction: prevention and protection. Within the realm of prevention three areas addressed are process design, physical plant design, and procedures and practices. This volume details primary hazards addressed by control technologies or practices in each of these three areas of prevention. It also details technological options for protection from a release once primary containment has failed. The second volume, planned for the future, will extend this work to include mitigation technologies which deal directly with reducing the consequences of an accidental release that has already occurred.

2.4 ROLE OF PREVENTION REFERENCE MANUALS IN SCAQMD RULEMAKING AND INSPECTION ACTIVITIES

Each PRM has a distinct role in the overall rulemaking and inspection activities of the SCAQMD. Some of these activities can be inferred from the preceding discussions. Overall, the manuals provide a basis for establishing an inspection program and for training and guiding inspectors, provide technical material to aid in the evaluation of control plans for release prevention or risk reduction submitted to the district under the rule, and also aid industry in implementing, developing, and upgrading internal company programs for release prevention.

The manuals provide the technical basis for:

- Setting priorities for selecting facilities for inspections based on types of chemicals and operations at these facilities,

- Defining what regulatory personnel should be looking for in inspecting facilities and in reviewing emergency or control plans for facilities,

- Defining what a company should be addressing in design, construction, and operation for minimizing the potential for accidental releases.

Figure 2-2 illustrates the role of the PRMs in a potential SCAQMD regulatory process. At the time this report is being issued, the draft manuals are still in progress.

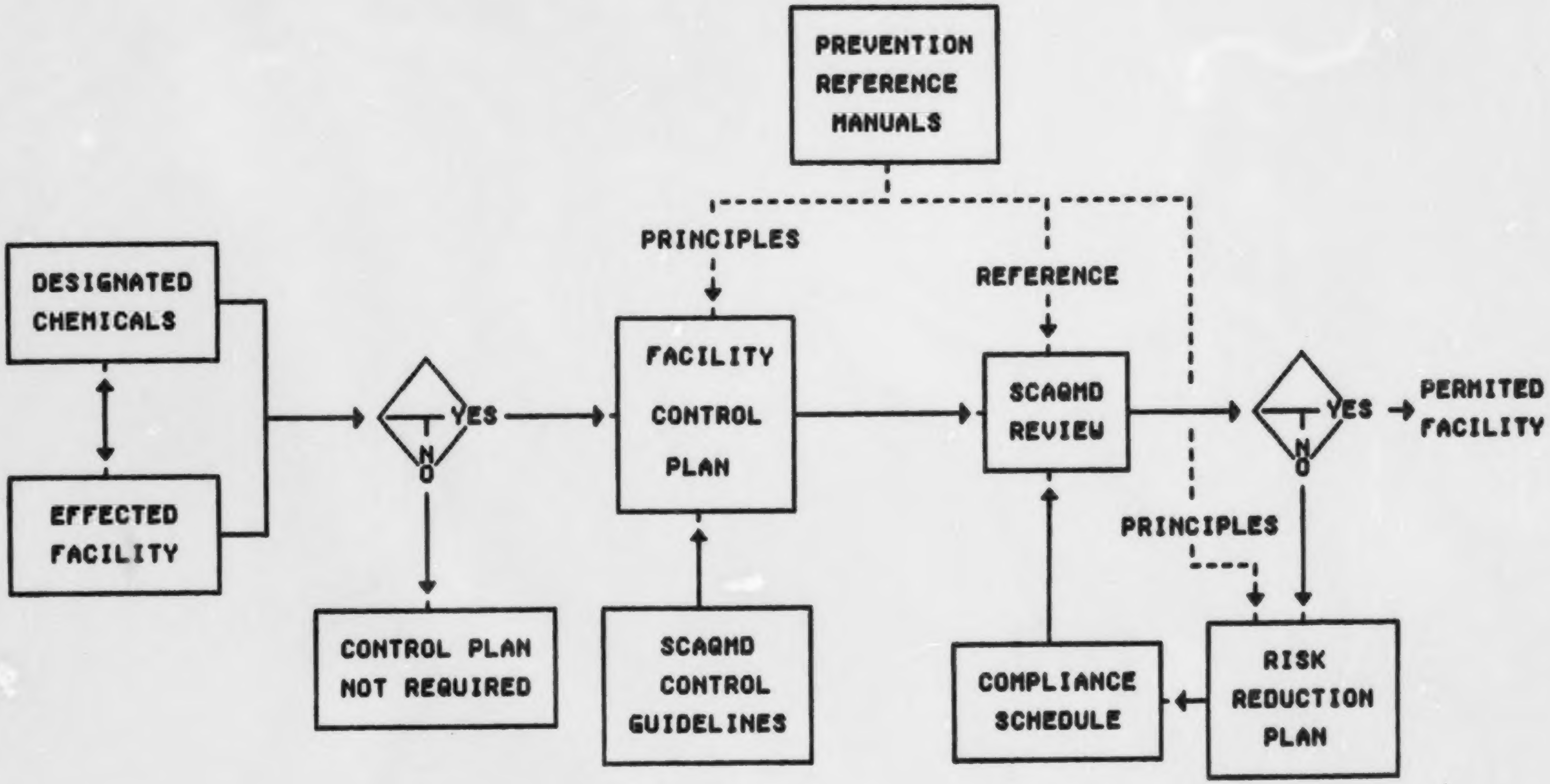
PREVENTION REFERENCE MANUALS
PRINCIPLES
REFERENCE
DESIGNATED CHEMICALS
EFFECTED FACILITY
YES
NO
FACILITY CONTROL PLAN
SCAQMD REVIEW
YES
NO
PERMITED FACILITY
PRINCIPLES
CONTROL PLAN NOT REQUIRED
SCAQMD CONTROL GUIDELINES
COMPLIANCE SCHEDULE
RISK REDUCTION PLAN

Figure 2-2. Role of prevention reference manuals in potential SCAQMD regulatory process.

SECTION 3

TECHNICAL MATERIALS PROVIDED TO SCAQMD

The technical materials provided to the SCAQMD as a result of this technical effort were primarily:

- An initial outline of a draft rule for review and comment,
- An example draft rule, and
- Technical input to the rule, both directly in the draft and in the Prevention Reference Manuals.

3.1 DRAFT RULE

The example rule demonstrated how the technology and practices of release prevention could be incorporated into the rule format commonly used by the SCAQMD in other areas. Major areas addressed by the rule include:

- Purpose
- Applicability
- Definitions
- Registration
- Accidental Release Control Plan
  - -- Plan Requirements
  - -- Variances
  - -- Action on Plans and Variances
- Risk Reduction Plan
- Control Considerations
- Recordkeeping and Reporting
  - -- Recordkeeping
  - -- Reportable Releases
- Compliance Schedule

- Plan Amendments Approval, Transferability, and Plant Closure
  --Plan Amendments
  --Transferability and Plant Closure
- Severability

The details of these areas are contained in the example draft rule presented in Exhibit D.

3.2 TECHNICAL INPUT TO THE RULE

Primary direct technical input to the rule included technical definitions, the concepts of accidental release control plans and risk reduction plans, and a summary of specific chemical process or storage facility areas and hazard control considerations which could be addressed in these plans. This input was incorporated as an exhibit contained in the draft rule and is included with the draft rule in Exhibit D of this report.

An outline is:

- Siting and Layout Controls
  -- Siting
  -- Layout

- Process Controls
  -- Chemical Processes
  -- Chemical Storage

- Equipment Controls
  -- Foundations
  -- Structural Steel
  -- Vessels
  -- Pressure and Vacuum Relief Systems

-- Pumps and Compressors
-- Heaters and Furnaces
-- Heat Exchangers
-- Turbines
-- Electrical Equipment
-- Instrumentation
-- Piping

- Emissions Control Devices

- Fire Protection and Safety

- Operational Controls
  -- Chemical Compatibility
  -- Materials Handling
  -- Waste Management Practices

- Management Controls
  -- Operator Practices and Training
  -- Fire Protection and Prevention
  -- Contingency Plan and Emergency Response Coordination
  -- Maintenance

Additional technical input included development of a suggested registration form incorporated as part of the draft rule.

Another part of this technical input for rule development was in the form of the PRMs discussed previously. Preliminary tables of contents for these manuals, which are still in progress, are presented in Exhibit E.

EXHIBIT A

SOUTH COAST AIR BASIN
ACCIDENTAL TOXIC AIR EMISSIONS STUDY

EXHIBIT A

SOUTH COAST AIR BASIN ACCIDENTAL TOXIC AIR EMISSIONS STUDY

Eugene F. Calafato, consultant (crisis management)
Robert Antonoplis, Engineering Division, SCAQMD
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September 1985

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PART I

INDUSTRY SAFETY

INTRODUCTION

Early in the morning of December 3, 1984, an accidental release of methyl isocyanate (MIC), a toxic gas, occurred in Bhopal, India, resulting in the deaths of more than 2,500 people. This incident focused world attention on the potential for calamity from the accidental release of toxic emissions into the atmosphere.

On January 4, 1985, the Governing Board of the South Coast Air Quality Management District, concerned about the possibility of a Bhopal-type disaster occurring in the South Coast Air Basin (SCAB), directed that a study be undertaken to assess: (a) the ability of the petrochemical industry to avoid a chemical disaster of Bhopal proportions; and (b) the ability of the four counties (Los Angeles, Orange, Riverside and San Bernardino) to respond, in a timely and effective manner, if such a disaster did occur.

Three principals were selected by the SCAQMD Executive Officer to conduct the study. They are: Mr. Robert Antonoplis, Engineering Division; Mr. Eugene Calafato, consultant (crisis management); and Dr. Ike Yen, consultant (safety systems). In addition, the resources of the SCAQMD staff were made available on an as-needed basis. The study was a six-month effort with a final report due by July 15, 1985.

PART I

Part I of this study addresses the ability of the petrochemical industry in the SCAB to avoid a chemical disaster of Bhopal proportions.

PARAMETERS AND APPROACH

1. This aspect of the study addressed itself to accidental toxic air emissions from stationary sites that have the potential of resulting in widespread injury and damage, i.e., casualties in the thousands and property damage in the millions. Manufacturing, processing and storage facilities, and waste treatment storage and disposal sites were included in the survey.

2. The accidental release of toxic materials during transport, whether by ship, truck or railcar, was not examined as part of this study. However, since there is such direct relevance between community preparedness and the threat posed by the transport of hazardous materials interstate and intrastate, some comments and observations are included herein with regard to mobile systems.

3. After consultation with the Office of Emergency Services (OES) in Sacramento, it was decided to focus the study primarily on approximately 100 chemicals listed in a publication on chemical hazards issued by the National Institute for Occupational Safety and by the Occupational Safety and Health Administration. These chemicals have an immediately dangerous to life and health (IDLH) value of 2,000 ppm or less, and a vapor pressure of 10 mm Hg or higher at ambient conditions. This list was supplemented from three other sources: (a) the Department of Transportation (DOT) Emergency Response Guidebook listing those chemicals that, if spilled, are likely to result in evacuation; (b) the DOT Poisons A List; and (c) the legal carcinogens that are gaseous or have a vapor pressure of approximately 10 mm Hg or higher under ambient conditions (Attachment 1).

4. A mail survey was conducted of 197 companies in the SCAB. The questionnaire requested detailed data regarding types and quantities of hazardous chemicals processed or stored and concentrated exclusively on safety practices, procedures and technology. The companies were selected for participation based on SCAQMD records and with substantial input from the District staff. The criteria for selection included company type, size,

location, product and other factors that would constitute a representative sampling of the petrochemical industry. Attachments 2 and 3 provide a listing of these companies, and a copy of the survey questionnaire with the District cover letter.

5. Information obtained from the mail survey was reviewed to determine the types and quantities of toxic substances stored, processed, or otherwise used by the various companies. Based on this, the companies were ranked according to the following index:

$$\frac{\text{Quantity of Toxic Substance (lbs)}}{\text{IDLH Value of Substance (ppm)}}$$

A total of nineteen companies (Attachment 4) were then selected for on-site audit based on the inventory of chemicals (type and quantity), the type of industry, size of operation, location, inputs from local fire department personnel and the subjective judgment of the project staff.

The on-site audits focused on the procedures and equipment used for the handling, storage, and use of the toxic substances; the overall safety policies and procedures of the companies; the attitude of management toward safety and a visual inspection of those areas of the plant where toxic materials are stored or processed. The latter included discussion with personnel responsible for the processing operation. The checklist for these audits is included as (Attachment 5).

6. In parallel to the surveys, an analysis was made of the Bhopal incident in order to establish a basis for assessing the degree to which the SCAB may be at risk in terms of an incident of similar gravity.

DEFINITION OF TERMS

Risk Assessment

Historically, the absence of an adequate data base has brought into controversy the exactness and limitations of risk analysis. In regard to this study, it is noted at the outset that chemical hazards pose an inherent uncertainty in their identification and in estimating the probability and the consequence of events. It is not uncommon that for some risks of very low probability there may be uncertainty by a factor of ten. However, even a rough estimate may draw attention to hazards which may not previously have been recognized or mistakenly dismissed as trivial. While acknowledging this lack of preciseness, due in great part to imperfect and incomplete technical/scientific information, we have proceeded on the assumption that decisions impacting safety must nevertheless be made, and measures must be taken, even when the lack of an experience factor or comprehensive data base leave some margin for discussion and dissent. It is further noted that risk assessment, taken in its broadest sense, would also consider factors, such as public attitude, which not only vary with time, but often rapidly.

Whereas risk assessment is basically an analytical process, firmly based on scientific consideration, it inevitably requires judgments to be made when the available information is incomplete or necessarily subject to interpretation. For the purposes of this report, there has been some quantification of risk, but the findings are also based on qualitative judgments. Certain value judgments have been made regarding the acceptability of risk evaluated in terms of cost and other factors associated with control and safety.

Risk Acceptability

Here again, different interpretations are taken of what acceptable or unacceptable risk really means. For purposes of this report, it is noted that there is no simple relationship between the acceptance of risk and its detriment, or indeed between acceptance and acceptability. The fact that a risk is accepted is by no means a guarantee of its acceptability. In addition, the acceptability of the risk of a rare but serious event, i.e., a major chemical disaster, may be dramatically altered if the reality of the hazard is demonstrated by the occurrence of such an event, even if the occurrence confirms the realism of the previous estimate of the risk. We do not speak of risk as acceptable or unacceptable in isolation, but only in combination with the costs and benefits that are attendant to that risk. Considered in isolation, no risk is acceptable.

BHOPAL ANALYSIS

Background

Due to litigation currently in progress, definitive information on certain aspects of the Bhopal incident remains, at least publicly, unknown. The following review and analysis is based on the Union Carbide Corporation Bhopal Methyl Isocyanate Incident Report dated March 1985 and on a series of investigative reports published in the New York Times.

First, some background considerations that bear on the Bhopal incident. Western technology came to Bhopal, but not necessarily the infrastructure for that technology. Although positive evidence has not been surfaced in this regard, there are strong indications of deficiencies such as the non-availability of competent personnel, lack of training of plant personnel, and inadequate upkeep and maintenance of the operating equipment and the backup safety systems. Workers, operating by rote, may not have been aware of the consequences of their actions and inactions. Industrial countries exhibit a sense of urgency with regard to safety problems and the attention given to worst-case possibilities is relatively routine. Not so in most developing countries where machinery often becomes quickly outdated, availability of spare parts is limited, and maintenance is, at best, marginal. Another factor in Bhopal is that the population grew rapidly and without zoning laws. No buffers were established around high risk factories, notwithstanding the attendant danger to overcrowded areas.

An important factor impacting the Bhopal incident is the lack of emphasis on preventive maintenance. Dr. Shrivastava, Assistant Professor of Management at the NYU Graduate School of Business Administration, and a native of Bhopal, noted that just because the technology arrives on the premises of a subsidiary doesn't mean that it is transferred and assimilated into the workforce as a whole. Part of the transfer is the consideration given to operating errors, design flaws, maintenance failures, training deficiencies, and economy measures that combine to endanger safety. All these factors are far more likely to occur in an environment where there has not been a preconceived orientation toward safety at the grass-roots level.

Methyl Isocyanate Release

Union Carbide India, Ltd., operated an insecticide plant in Bhopal, India. Methyl Isocyanate (MIC) was used as an intermediate in the insecticide manufacturing process. It was stored in two partially buried 15,000 gallon tanks. A third 15,000 gallon spare tank was available for emergency storage or for temporarily storing "off-specification" MIC. The storage tanks were equipped with a refrigeration system to hold the MIC temperature at 0°C. In addition, there were a vent gas scrubber and a flare tower to absorb or burn any gases vented from the MIC tanks.

Late in the evening of December 2, 1984, MIC odors were reported in the area. An earlier test had shown that the MIC storage tank that eventually leaked could not hold pressure. Later, it was also noted that the pressure in the tank rose from 2 psi to 10 psi during a 40-minute period. Notwithstanding these indications of possible trouble, no remedial action was taken.

Later in this report a comparison will be made between the safety assessment of the petrochemical industry in the South Coast Air Basin and the Union Carbide Bhopal incident.

At 12:15 a.m. on December 3, the field operator reported a release of MIC. Apparently, there was an effort to start the vent gas scrubber, to cool the MIC tanks, and knock down the gases by directing water at the MIC leak. The effect and duration of these remedial actions are unknown. Union Carbide India Ltd. reported that the safety vent valve reseated itself sometime between 1:30 a.m. and 2:30 a.m. It has been estimated that a maximum of 90,000 lbs. of MIC may have been released.

Factors Impacting the Release:

A review of the reports on the Bhopal incident indicates that it occurred due to a confluence of events and circumstances:

1. Disregard of Safety System Indicators

Apparently, the plant continued its operation in spite of the fact that the refrigeration system, the vent gas scrubber, and the vent gas flare tower were out of commission. (Several hours before the massive leak, there were indications of malfunction of the equipment. No corrective action was taken.)

2. MIC Storage

The MIC was stored in large tanks near densely populated areas. Also, the spare tank was being used for the temporary storage of "off-specification" MIC, and thus it was unavailable for transfer of MIC from the leaking tank.

3. In-Plant Response

After the massive leak occurred, the plant response was poorly coordinated. It is not clear that the plant had an emergency plan or that any practice drills had been held simulating response to a MIC leak.

4. Community Response

Communication between the plant and the community was poor. It is not known how the community was notified or how it responded during the critical hours after the leak was first discovered.

5. Medical Response

There was confusion regarding the determination of appropriate treatment of the exposed victims.

6. Time

The leak occurred around midnight when the community was asleep.

7. Weather

The weather was reported as brisk, temperature was 57° F and the wind was from the northwest blowing toward a densely populated area.

This confluence of events resulting from human errors, equipment failures, time of day, and meteorological conditions led to a worst-case scenario and casualties into the thousands.

SURVEY FINDINGS

Chemical Inventory

Based on the survey data provided by 197 petrochemical companies, a list of toxic chemicals was compiled which are present in the SCAB in sufficient quantities to potentially cause a major incident if accidentally released into the atmosphere under certain conditions. These are: chlorine, hydrogen fluoride, hydrogen chloride, anhydrous ammonia, chloropicrin, gasoline lead additive, vinyl chloride, and benzene.

1. Chlorine

This is the most prevalent toxic chemical present in the SCAB. It is used for water disinfection and the manufacture of many different chemicals including household bleach and detergents. The maximum amount found stored at one location was 540 tons; the maximum stored in one container was 90 tons.

2. Hydrogen Fluoride

This chemical is used in the manufacture of refrigerants and the production of gasoline. It is transported to the SCAB by railroad or tank trucks, and then it is transferred to large on-site storage tanks with capacities of up to 25,000 gallons.

These tanks are usually elevated ten feet or more above ground level to prevent vehicles from accidentally damaging the tanks. Also, the tank area is diked to contain any spills. Some tanks are equipped with water sprays and others have fire monitors in their proximity so that water can be used to knock down any leaking gases. One user has taken the added precaution of dedicating one spare tank as backup for draining the hydrogen fluoride in case of leaks in the main storage tank. This type of redundancy is not the rule today; however, it reflects a standard that other companies should emulate.

3. Hydrogen Chloride

This chemical, usually present as a 31 percent water solution, is used in many chemical manufacturing processes, and it is also a by-product of many processes using chlorine.
Hydrogen chloride solutions are generally stored in large tanks of up to 100,000 gallon capacity. These tanks are always diked to catch any spills and some are further protected by foam sprays or water sprays to prevent vaporization of the hydrogen chloride in case of a leak.

4. Anhydrous Ammonia

Anhydrous ammonia is used in many chemical processes and is also a fertilizer. It is usually stored in liquid form in large tanks of up to 25,000 gallon capacity. As a rule, these tanks are protected in the same manner as the hydrogen fluoride storage tanks, i.e., elevated, diked, and with water sprays or fire monitors to knock down leaked gases.

5. Chloropicrin

This chemical, used as a fumigant, is the only toxic chemical of special significance in this study that is manufactured in the SCAB. It has a relatively low IDLH value of 4 ppm and a vapor pressure of about 20 mm Hg under ambient conditions. The chloropicrin located in the SCAB is stored in two 32,000 lb. holding tanks and in many DOT approved containers at the manufacturing plant.

6. Gasoline Lead Additive

This is a chemical mixture containing tetraethyl lead, tetramethyl lead, ethylene dibromide, and other chemicals. It is used as an additive in gasoline to increase its octane rating.

Gasoline lead additive is present in significant quantities in gasoline refineries. It is stored in tanks with capacities of up to 160,000 lbs. The two major manufacturers of this chemical mixture are the Du Pont and Ethyl Corporations, and each imposes stringent handling and storage procedures.

7. Vinyl Chloride and Benzene

Vinyl chloride is used in the making of PVC plastics. It is transported to the SCAB in railroad tank cars and is then transferred to large storage tanks. The largest storage tank in the SCAB has a capacity of 6,000,000 lbs.

Benzene is used in the making of many chemicals. It arrives in the SCAB by sea and is stored in a 1,000,000 gallon storage tank. From here it is then transported by tank trucks to various locations.

Both chemical compounds have relatively high IDLH values but are classified as carcinogens. In the event of a major release, the immediate death toll may not be high, but the long-term effect of such exposure is debatable.

8. Bromine, Phosgene, Phosphorous

These additional chemicals merit mention. Bromine and phosgene, used in the manufacture of pesticides and specialty chemicals, would ordinarily warrant inclusion in the above list due to their high toxicity. However, the known inventory in the SCAB is of such small quantity as to effectively rule out the possibility of a Bhopal-type disaster. Phosphorus is both toxic and combustible and is used to make sodium tripolyphosphate, an ingredient often used in detergents. Although the inventory is substantial, its toxicity is mitigated by the fact that it spontaneously combusts when it comes in contact with air. Whereas phosphorous oxide reacts with water to form phosphoric acid, the latter, although a strong and corrosive acid, is not toxic.

The aforementioned listing of chemicals is not all-inclusive in terms of those that pose a potential threat to the basin. It reflects an inventory keyed to 197 companies that, of themselves, are a representative sampling of the petrochemical industry located in this basin.

Proximity to Population

The industry phase of this study focused primarily on those areas of the SCAB that have the highest percentage of hazardous materials processed or stored in proximity to populated areas. Hence, most of the industry data was drawn from Los Angeles and Orange counties. However, San Bernardino and Riverside counties are rapidly inheriting many of the same disaster preparedness problems as industry continues its move from the more congested areas of the basin.

Safety

Information from the industry survey and the on-site audits indicates a wide variance among companies in their respective safety policies, procedures and practices, as well as in the safety attitudes reflected by management. As a rule, the major corporations took a more systematic, comprehensive, and closely monitored approach toward employee safety training. This is reflected in the regularity with which safety meetings are held, the agenda for these sessions, the active participation of supervisors and top level management personnel, and the quality of formal training given to the employees. Also there is, in general, a more deliberate and positive approach taken toward developing a dialogue with the outside community. An example is the Union Oil Company's efforts at its Brea plant to foster a more comfortable relationship with the City Council and with the community based on a freer exchange of information.

This is not to say that none of the mid-size or small companies are moving in these same directions. However, the survey generally indicates that the smaller the company the less structure one will find in the safety program, and the less attention being given to actively promoting better community relations. There are, of course, always exceptions--and at both ends of the spectrum. For example, at the Paramount facility of the Paramount Petroleum Corporation, management is taking a major initiative, with attendant costs, to develop ways of reaching out to the local community in an effort to enhance its relationships. In this case, the limited number of plant personnel (approximately 142 employees) has not been a deterrent to forward thinking. Conversely, some of the major corporations which continue to pollute the air through small, periodic emissions, suggest by this behavior a safety program that may be more cosmetic than effective. And certainly there are some major corporations which continue to adhere closely to a policy of almost total insulation from community interaction--until a problem actually surfaces.

It is also a fact that the size and financial resources of a company often will dictate the amount of redundancy found in mechanical safety systems, even in cases where additional systems may be virtually a necessity. In the latter instances it is not unusual for companies to rationalize that the lack of any serious safety mishap in the past is justification for complacency regarding the future. Yet, an objective assessment would strongly suggest that time does not run in their favor. For example, one company, small at its local site but medium-sized nationwide, with a poor safety record, and currently under litigation with the EPA and DHS, has been storing dichlorobenzene in a tank with no containing dikes, and using chlorine with almost complete dependence on the safety systems that come with the railroad tank car. The risk here, and in the case of other companies following either questionable safety practices or maintaining marginal safety standards, is not of a Bhopal-type disaster. However, there is the real and ever-present danger of serious injury to plant personnel, with the potential for at least moderate adverse impact on the immediate surrounding community.

Earthquake

The likelihood and severity of toxic emissions caused by earthquake damage to toxic substance containers cannot be accurately addressed in this report due to insufficient relevant data.

We do know, however, the following: Since mid-1982, the Federal Emergency Management Agency (FEMA) is on record with a finding that the probability has doubled of an earthquake in California of 7.0 magnitude or greater; the California state geologist reports that California has entered a period of greater seismicity than experienced during the previous 25 years; some authoritative sources state unequivocally that an earthquake of 8.0 to 8.5 magnitude is a virtual certainty within the next 20 years; and it is generally conceded within industry and among preparedness officials that although progress is being made, the SCAB is not today adequately prepared for a catastrophic earthquake of the magnitude indicated above.

Our disaster preparedness study confirms that only the smallest percentage of companies have included an earthquake contingency in their emergency plans. They have placed total reliance on the local fire and police/sheriff departments. The details of this reliance are at best nebulous. A worst case, though not unlikely, scenario postulates severe, simultaneous toxic chemical emissions across a broad spectrum of plants. Given such a situation, today's planning is almost totally inadequate and this would be reflected in the execution of these plans.

Sabotage

Planning for this contingency among petrochemical companies in the basin is virtually nonexistent. Total reliance is placed on state and federal authorities. Although this report does not address the likelihood of such an occurrence, if it should occur the potential for a major catastrophe is high.

Human Error

This factor will always be a consideration. However, due to the effectiveness of company training programs, the degree of safety consciousness permeating the workforce and the investment being made in mechanical safety systems, the likelihood of human error resulting in a catastrophic occurrence of Bhopal proportions is negligible.

REGULATION OF TOXIC SUBSTANCES

Bob Griffith, who heads Orange County's hazardous material program, and other authorities in this business, have repeatedly pointed out that one of the anomalies of today's health and environmental regulations is the lack of an infrastructure and the ambiguity of certain regulations which inhibit more stringent control of toxic substances. Yet, once a toxic substance is declared a waste, the control requirements are clearly spelled out and lead agency responsibility is well-defined. However, if the toxic substance is not declared a waste, it can be moved and handled with significantly fewer control requirements. In a most incisive article dated 3 July 1985 (subject: Toxic Fires Can Be Anywhere) Kim Murphy and Ronald B. Taylor of the L.A. Times reinforced this and similar points. They note that the Uniform Fire Code and the Uniform Building Code provide some protection, but often local government and their fire departments do not have the manpower or expertise to fully enforce toxic substance control requirements.

Murphy and Taylor surface certain other relevancies as well. For instance, there is a natural reluctance among enforcement agencies to become involved with the manufacturing processes of private industry. Similarly, private industry jealously protects these processes from outside scrutiny by shielding them under the cloak of "proprietary interest." Both positions are understandable, but they also complicate regulation of toxic substances and sometimes result in conditions of less than acceptable safety.

Recently, increased emphasis has been placed on the need to exercise more control over toxic substances, both to protect the safety of emergency response personnel and that of the general public. The key to this is identifying the substances and knowing where they are located. Accordingly, some local jurisdictions have enacted so-called "right-to-know" laws. This reflects progress. However, enforcement of these laws has been made difficult due to limited resources, both money and manpower. Nevertheless, the laws remain an important tool without which effective emergency response will be severely handicapped. (See Ref. #1).

Size of Containers

In terms of economy, it is often more economical to use a single large storage tank than several smaller tanks. From the point of guarding against a large catastrophic toxic release, multiple smaller tanks are by far preferable. Toward this end, guidelines should be developed to limit the maximum size of containers allowable for different toxic substances.

Cradle-to-Grave Monitoring

The control of toxic waste is based on the use of a manifest system that tracks the waste from the point of its generation to its final point of disposal. Consideration should be given to developing a similar system for tracking and control of toxic substances within the SCAB.

Coordination Among Agencies

At present there are innumerable agencies with jurisdiction over various aspects of toxic substance control. Even assuming that each role can be legitimized, better liaison and communication among this team of players is imperative. (More about this will be said in Section 2 under Community Preparedness.)

Precautions During Abnormal Periods

It was noted during the survey that accident rates sometimes increase during periods of corporate stress. Regulatory agencies should consider this and exercise particularly close scrutiny over companies being operated under the provisions of Chapter ll or during the early periods of a plant strike.

Facility Retrofit

In recent years, a number of chemical plant disasters have resulted from phenomena where a certain set of conditions or sequence of events occurred for the first time, even though the process had been in use successfully and safely for many years. In some of these instances the problem, directly or indirectly, was one of an aging chemical producing or consuming plant operating with few, if any, mechanical safety systems. Many of these plants will be in use for decades to come. The price of remaining alert to the improvement of accident prevention features, safety techniques and safeguards may, in some instances, require expenditures that will adversely impact the company's competitiveness in the marketplace. It is unrealistic to anticipate, in all instances, initiatives by management that result in burdensome expenditures, unless the retrofitting of designated facilities is mandated by law. This would require not only the passage of legislation, but also further appropriations to fund the resources that will be needed to make enforcement practical.

COMPARISON OF SCAB ENVIRONMENT TO BHOPAL

There is a high degree of safety consciousness among industry in the SCAB. Even in those companies where we have noted considerable room for improvement in safety practices, attitudes, procedures and safety precautions still rate very favorably when compared to the conditions that reportedly led to, and were operative during, the Bhopal crisis. Safety awareness in the United States among the major petrochemical companies having the type of chemical inventory most susceptible to large scale toxic emissions, did not begin with Bhopal. Other pressures, over the years, have been driving the companies toward better preparedness. Bhopal, however, accelerated the pace. Protracted and costly litigation on environmental and safety matters, spiralling insurance costs (to be discussed in more detail later in this report), rising community indignation over real and perceived environmental malpractices by industry, the exercise of ever-tightening legislative control (federal, state and local), and the development of a more pronounced moral consciousness toward safety matters in corporate board rooms had motivated industry to take note and respond favorably long before world attention was focused on Bhopal. Hence, most of the negative factors that were operative in the Bhopal incident are not relevant in the SCAB.

The equipment used in the SCAB for the storage and handling of toxic substances is, generally, of excellent quality and well maintained, even though the degree of redundancy in mechanical safety systems should be improved in some instances.

One of the main factors contributing to the severity of the Bhopal disaster was the exceptionally close proximity of highly populated areas to the plant site where MIC was processed and stored. While population density may seem high in the SCAB, and notwithstanding the location of certain housing tracts close to our industrial sites, there is no comparability to the situation that prevailed in Bhopal.

Furthermore, our local fire and police agencies know the hazards in their jurisdictions. They are prepared, well trained, and highly motivated; in effect, an exceptionally professional force able to respond, in most instances, quickly and effectively. Given these capabilities, a localized incident would not be permitted to degenerate into a Bhopal situation. Also, from a medical standpoint, we would not have the same dearth of knowledge regarding casualty treatment that existed in Bhopal.

Based on the above, one can conclude with reasonable assurance that the factors which contributed to the Bhopal disaster—including the confluence of events and circumstances—are not factors in the SCAB. This by no means rules out the possibility of periodic accidental toxic releases which may result in some deaths and consequential damage. The aging of plants and equipment (referred to later in this report) certainly heightens this possibility, but the severity of such incidents would not approach Bhopal.

LIABILITY INSURANCE

An authoritative and insightful source recently discussed the insurance industry's changing attitude toward underwriting industrial risks, and the impact this is having on safety policies and practices in the petrochemical community. It was noted that the Bhopal incident came after three of some of the worst years, financially, in the history of the insurance industry. Insurers are today taking a very hard look at what types of risks they will cover, how much of that risk they will cover, and what they will charge for the coverage. The Bhopal disaster is not the spark for this tough approach, but coinciding as it does with the insurance industry's effort to raise itself out of a three-year slump, it certainly has served to accelerate the trend.

The point was made that along with other industrial firms, chemical companies are facing far more expensive and restrictive liability insurance policies. Already there is evidence that rates are skyrocketing; knowledgeable sources predict that in the relatively near term we may expect to see rate increases of some 150 to 200 percent for lower-layer coverage, i.e., coverage less than $50,000,000 per occurrence. For upper-layer insurance, the rate increases will probably be greater.

Concurrently, insurance companies are taking advantage of the market turnaround to change or eliminate many of the provisions of old policies that have become onerous to them. Most significantly, they are pushing hard to change commercial general liability policies from "basis of occurrence," under which coverage is provided for injury and damage occurring during the policy period, to "claims made," under which coverage is provided if the claim for damages is first made during the policy period. It is anticipated that by January 1, 1986, restrictions of this type will have become prevalent in the marketplace.

According to this source, the particular target of the changes in this commercial general liability program, and one that especially affects the chemical industry, is pollution coverage. Chemical companies are especially vulnerable to the occurrence issues arising under the existing policy provisions because pollution-related damage or injury is often latent. There can be many causes of injury and there may be no aggregate limit on the coverage. Under the existing policy provisions, pollution liability is not covered except when due to sudden and accidental emissions. This terminology meant to exclude coverage for latent-injury causes, but was not always interpreted that way in the courts. As a result, the new provisions being promulgated in the insurance industry will eliminate coverage for most pollution liability. Therefore, to insure against this liability, most chemical companies will be forced to turn to environmental impairment liability policies. The problem here is that such policies are not generally available. Hence, the overall impact on the chemical producers is likely to be greater resort to self-insurance.

All of this has heightened industry's attention to safety and accident prevention. In-house recommendations to implement certain safety measures are finding a more receptive ear. And this bodes well for the future. Here in the basin, industry is commissioning more outside studies to assess its state of safety and these include the application of relatively sophisticated analytic techniques. From industry's standpoint this is an investment toward preserving assets. From the vantage point of the community, better safety is the product.

INDUSTRY INITIATIVES

Industry efforts in the preparedness area have not been limited to unilateral actions directed by and affecting only individual corporations. The need for cooperative efforts has been recognized and some segments of the industry are moving ahead aggressively. The following examples are cited:

Chemical Manufacturers Association (CMA) is implementing two major programs aimed at enhancing emergency response and improving the flow of chemical hazard information to the public. They are the Community Awareness and Emergency Response (CAER) and the National Chemical Response and Information Center (NCRIC).

The CAER is a coordinated effort to establish or revitalize chemical industry emergency response plans and to integrate them with community plans. It relies heavily on the chemical plant manager to act as a catalyst, i.e., to work with emergency response officials of neighboring industries and local community members. Additionally, the new program will make the hazard information now available to chemical workers and emergency services also available to the public. It will help plants communicate with their communities on chemical emergency plans; integrate them into overall emergency networks; and assure that all steps in the critical planning process are considered.

The intent of CAER is to individually tailor each community program to meet its specific local needs. In general, the program would respond to these types of questions: (l) Who are the key people concerned with community emergency response and what are their roles?; (2) What are the risks, and how great are they?; (3) What plans already exist?; (4) What changes are needed to improve existing plans and to coordinate individual plans with the overall community plan, thereby assuring a truly integrated effort in the event of an emergency?; (5) Is the coordinated plan in writing?; (6) Are emergency responders trained, and concerned community members educated in the planning process?; (7) Are procedures established for periodic testing, reviewing, and updating of the plan?; and (8) Is the public-at-large involved in the total community emergency plan?.

The role of the NCRIC is to establish a clearing house for chemical emergency help and hazard information, and for the training and response activities associated with the use and distribution of chemical products. A key feature is an expanded Chemical Transportation Emergency Center. Under this program, the Center will provide information for all major chemical emergencies, not just transportation-related accidents.

Another feature is implementation of CHEMNET, a mutual aid network of company and "for-hire" emergency response teams whose purpose it is to place chemical experts at the scene of a serious accident in a minimum amount of time. It will also provide training for personnel, such as those in police and fire departments, who usually respond first during a chemical emergency.

A related service is provided by the Chemical Referral Center (CRC) for nonemergency information regarding a chemical product. CRC will serve as a referral agency, taking requests for information from the public on its "800" telephone number; matching the inquiry to a company that can answer it; and providing the caller with the company's name, address, and phone number.

Also, the American Institute of Chemical Engineers has established a Center For Chemical Plant Safety to address four issues: hazardous evaluation procedures, bulk storage and handling of toxic or reactive materials, plant operating procedures, and safety training.

All of this reflects a meaningful beginning and points in the right direction. However, these programs represent initiatives (and reasonably so) by the large corporations. Much will need to be done to get the attention, participation, and commitment of the medium-size, and, particularly, the small-size companies, who may not immediately recognize the need or the potential benefits accruing to them. In addition, these efforts must become a two-way street; i.e., both the communities and the local preparedness organizations must reach out and take similar initiatives if all this is to be anything more than a knee-jerk reaction that quickly loses its priority and long-term value.

TRANSPORT OF HAZARDOUS MATERIALS

At the beginning of this report it was noted that the transport of hazardous materials by truck and railcar was not within the charter of this study. However, in our discussions with both industry and community officials the "mobile issue" repeatedly surfaced. This issue is briefly addressed due to its general relevance to the overall preparedness aspect.

It is estimated that over a thousand new chemicals enter the United States' commercial market annually; and, at any given time, 70,000 trucks carrying hazardous materials are on the road. In addition, extensive railroad, barge, pipeline and air cargo transportation is regularly undertaken in this country. It is further estimated that 4 billion tons of hazardous materials are transported annually in the United States, and this is probably a conservative figure.

A recent article in The National Journal has pointed out that "under federal packaging and marketing regulations MIC can be transported in railroad or truck tank cars with minimum protection--sides of the containers simply market 'flammable liquid'--and yet remain in compliance. The liquid MIC released in Bhopal vaporized and did not ignite; its toxicity, not fire, doing the killing. In this country, Union Carbide--the only United States' manufacturer of MIC--voluntarily ships the chemical in its own specially designed, double-walled railcars. That is not unusual, i.e., the big chemical companies generally provide more protection for their dangerous cargoes than the law requires. However, the small chemical companies and other shippers and carriers of hazardous loads, as a rule, do no more than the regulations make them do." The enforcement aspect is also a likely problem. It is estimated that there are only 57 full-time federal inspectors for the 1,300,000 vehicles that carry hazardous materials.

The author, Rochelle Stanfield, makes the further point that despite the heavy volume of hazardous cargo, communities have remained relatively untroubled from transportation accidents involving hazardous material. Also, of the thousands of incidents reported to the Transportation Department each year, only 2 percent have been labeled severe, i.e., causing death, injury, or requiring evacuation. However, the potential for catastrophe is also clear. The author cites the derailment of 42 chemical cars in a 101-car train near Livingston, Louisiana in 1982. This forced the evacuation of 2,000 people and caused extensive property damage, though no one was killed or injured. In 1978, a derailment near Waverly, Tennessee killed 16 firefighters. There were eight deaths, 138 injuries, and several million dollars in property damage from a derailment near Youngstown, Florida in the same year. And the business district of Crescent City, Illinois was leveled in the explosive aftermath of a 1970 derailment. Given these incidents, we might ponder the consequences if similar accidents were to happen in the SCAB. Although we tend to read more about train wrecks than truck accidents, Ms. Stanfield notes that 85 percent of the hazardous cargo incidents reported to the Transportation Department occur on the highway, and all the deaths since 1981 from mobile sources have come on the road. One might attribute this to the fact that where hazardous materials are concerned, trucks make by far the most trips even though railroads carry the greater volume. (See Ref. #2.)

CONCLUSIONS

1. The Bhopal disaster was caused by a confluence of events and circumstances virtually unique to the localized situation existing at that location. The likelihood of a disaster of similar magnitude in the SCAB is minimal. This study could not accurately assess the threat from either earthquake or sabotage; however, both clearly pose the possibility of catastrophic disaster, even exceeding Bhopal proportions.

2. Accidental toxic air emissions resulting in death and injury to personnel within plant boundaries, and having adverse impact on adjacent communities, (generally within a two-mile radius) are a distinct possibility. These will be (hopefully) infrequent, without pattern, but an inevitable consequence of having such vast quantities of highly toxic substances in an environment where safety standards vary significantly; regulatory legislation has loopholes; enforcement of existing legislation is hampered by budgetary considerations; and population centers are located in such close proximity.

3. Emergency planning by industry is moving ahead at an accelerated pace, particularly among the major corporations. However, much remains to be

done, especially with regard to preparedness for earthquake and sabotage contingencies. Also, closer coordination is imperative among industries in geographic proximity to each other, and between industry and local agencies charged with disaster preparedness responsibility.

4. Industry/Community communication is improving, but remains sporadic and ad hoc. Few companies are according this matter the priority it merits.

RECOMMENDATIONS

1. Require all companies handling toxic substances to adhere to a prescribed safety standard tailored to specific chemicals and type of operation. This would include a sufficiency of mechanical safety systems to provide satisfactory insurance against equipment failure and human error. Based on deficiencies noted in the recent study, the following are some examples of the type of precautions that would be mandated under certain circumstances:

   a. Pressurized gas or liquid storage cylinders, storing toxic materials with an IDHL value of 2,000 ppm or less, and equipped with pressure relief valves and/or rupture disks must not vent directly into the atmosphere. The vented gases must be contained, absorbed, or destroyed.

   b. Tanks storing liquid toxic materials, whose vapors have an IDHL value of 2,000 ppm or less, and are heavier than air, must have leak-tight secondary containment. If the secondary containment is a diked area, then the atmospheric vent must open at the bottom of the dike and provision must be made to cover the vented vapors or liquid with a foam or other means, such that these will not emit uncontrolled vapors into the atmosphere. In addition, these tanks should be nitrogen blanketed.

   c. For plants handling toxic materials with an IDHL value of 2,000 ppm or less, the safe handling of which requires a constant supply of electricity, water, or other utility, a back-up supply source must be provided for the utility needed.

   d. The maximum size of storage containers should be limited depending on the toxicity of the material being stored.

It should be noted that the 2,000 ppm or less threshold was selected because it is consistent with the guideline recommended by the OES and adopted for this study. However, for purposes of any regulatory action, this threshold should be further reviewed.

If these tighter safety controls were enacted, it means concurrent funding of a suitably staffed (both in numbers and technical know-how) enforcement activity. It also means coordination among the myriad agencies of government involved in environmental protection to be sure industry is not burdened with needless and costly duplication or contradictory directives.

The responsibility for implementing this recommendation would more appropriately be with the State Legislature if standardization throughout California is a factor. However, one can readily foresee the difficulty of achieving the necessary political consensus. Two alternatives as stop-gap possibilities are: (a) add the new safety requirements to the current AQMD permitting system; or (b) add a licensing provision to the "right-to-know" ordinances which would link safety system requirements to what is reflected in the inventory. Under option (b), the responsibility could become that of city, county, or state government.

2. The District should reexamine its policy on the subject of Airborne Hazardous Material Incidents, dated September 10, 1982, and its Implementation Plan, dated August 5, 1982.

This review is timely as a result of the experience gained in the two recent pesticide warehouse fires. In both instances, the SCAQMD provided technical assistance on a 24-hour, multi-day basis. This is the first opportunity that the District has had to provide such assistance over an extended period since implementation of the policy. From the lessons learned here there may evolve recommendations for policy and procedural changes that would enhance responsiveness.

It is recommended that this reexamination include notification procedures, on-scene responsibilities, personnel equipment and training requirements, and cost recovery. Also it should address the appropriateness of providing this technical assistance automatically under certain pre-determined conditions, rather than by invitation only.

The automatic aspect is not meant to suggest that an SCAQMD presence be imposed on the counties. The intent of this recommendation is that there be an agreement negotiated with county authorities spelling out the circumstances under which the AQMD team would be automatically dispatched, and recognizing this service as an opportunity to have a valuable resource more expeditiously available to the scene manager.

We know time is a key factor in responding to incidents of accidental toxic air emissions. District expertise with regard to air monitoring, meteorological monitoring, and dispersion modeling is not readily duplicated in the SCAB. We know that the precision and accuracy of the measurements taken in the course of an emergency are necessarily subordinated to the need for quick answers. Hence, even if occasionally there is duplication in these resources, the double-check that a backup SCAQMD team might provide has merit of itself. But the case for District involvement actually stems from the Lewis Air Quality Management Act, which states that "...the SCAQMD is the sole and exclusive local agency within the SCAB, with responsibility for comprehensive air pollution control." Even though the SCAQMD was not intended to be an emergency response organization per se, it can be argued that there is a logical, even necessary, continuum between its day-to-day control responsibilities and being at the scene when air quality is out of control.

A further consideration is that the SCAQMD has high visibility in the SCAB and is recognized for its competency in air quality matters. Accordingly, its lack of presence, or late arrival, at the scene during a severe toxic air emissions emergency could be viewed by the affected community with disfavor, and erroneously suggest lack of interest by District management. Our citizenry could argue that, especially during an emergency, the community should not have to accept anything less than full and timely support; and that SCAQMD participation is not an issue over which there should be any vacillation, for while decisions are held in abeyance awaiting further developments, valuable response time is lost.

3. The SCAQMD has a special expertise in the measurement and identification of air contaminants; in the measurement and intrepretation of meteorological data; and in projecting airborne contaminant dispersion. Training in the use, and in the limitations, of measuring equipment should be made available to city and county HAZMAT teams, as appropriate. Also, the SCAQMD should be a prime participant in all exercises built around field simulation of hazardous releases.

4. HAZMAT Personnel Training

Training of HAZMAT personnel should be monitored by a single source to assure uniform standards and adequate capability. This could be a joint responsibility shared by the fire departments with assistance from the SCAQMD. However, the single point preparedness authority, that will be recommended in Part II of this report, should make this determination.

5. Toxic Chemical Training

More training, particularly for first responders, is required in: (a) the identification of the nature of the chemical threat; (b) the procedures for stabilization and neutralization of a chemical incident; and (c) the effective allocation of specialized resources. Since this training must come from several sources, there is a need for centralized management to ensure that the training is properly coordinated.

6. Availability of complete and current data on type, quantity and location of toxic chemicals is an urgent requirement. Comprehensive community chemical disclosure ordinances are the most direct and expeditious means of inventorying this information. Any such legislation should also take into consideration the resources needed to maintain the inventory system current. (Due to the relevance of these ordinances to community prepardness, reference will be made to them in Part II of this study under the Recommendations section.)

An example of the information to be included in these ordinances is as follows:

Chemical composition
Chemical reactivity
Handling and storage data
First aid data
Health hazard data
Special protection data
Fire/explosion hazard data
Spill and leak containment procedures
Fire and Emergency Medical System (EMS) response data
Emergency medical treatment data
Decontamination procedures

PART II

Community Preparedness

INTRODUCTION

This section focuses on an assessment of community preparedness in the South Coast Air Basin (SCAB); i.e., the ability of emergency preparedness agencies to respond, in a timely and effective manner, to a chemical disaster of Bhopal proportions.

Similar to the approach taken with industry, a questionnaire was sent to the director of each of the four county offices (Attachment 6) responsible for disaster preparedness in the SCAB, and to the mayors of 34 selected cities, (Attachment 7) requesting data relevant to community preparedness. Interviews were held with a broad cross section of officials, including fire department, sheriff, medical, communications and administrative personnel, at the policy, planning and implementation levels, who share in the responsibility for community preparedness. Also, reflected here is the substance of discussions held with many of the company officials who participated in the industry survey, and who surfaced thoughts and concerns regarding community interface and disaster preparedness. Finally, we drew from a vast data bank consisting of research studies and technical papers, particularly those sponsored by the Disaster Research Center at the University of Delaware and by the Nuclear Regulatory Commission, relating to natural and man-made disasters of the past. This information, in its totality, provides the basis for Part 2 of this report. There is ample evidence in each county that disaster preparedness is, indeed, a matter of concern and is receiving significant attention. However, although progress is being made, the pace of this progress varies both among the counties and with regard to specific aspects of the preparedness equation. For purposes of this study, we have selected key areas of community preparedness and examined these with regard to the SCAB as a totality, rather than relating them to individual counties or cities. There are two reasons for this approach. First, in the event of a major disaster, the key to effective response is integrated effort and cooperation across county lines. Hence, an assessment of overall preparedness is more relevant than the status of any particular jurisdiction taken in isolation. The second reason is to avoid the possibility that observations made in this report, however material, could be misconstrued and interpreted as critical of an individual agency or official charged with preparedness responsibility. This would be divisive and a disservice to those who simply see preparedness in a different light.

All personnel with whom discussions were held evidenced a high degree of dedication and professionalism, and a commitment to the preparedness function. there were, and remain, some differences of opinion as to the approach to be taken, and perhaps even the priority even the priority to be given, to certain aspects of disaster preparedness. But it is important to reaffirm at the outset the broad base of agreement that exists, and not magnify any disagreements out of proportion to their merit. This study recognizes the autonomy of city and county governments and the need to foster a cooperative, rather than competitive, relationship between these governments and other public agencies which share preparedness responsibility. Only in this context can there be an effective integrated planning.

APPROACH

Disaster preparedness has been the subject of study for many years by a concentration of multi-disciplined professionals. Through their efforts we have available to us a vast data bank of research information that has been quantified with an academic detachment which enhances its credibility. As noted earlier, we have drawn substantially from this material, using it as a yardstick to measure community preparedness. The philosophies outlined in the section on preparedness climate and perceptions, community disaster planning, vertical linkages, specialized/compartmentalized planning, evacuation and the emergency medical system are, in effect, extracts from previous relevant research. These tenets have withstood the test of time. In each case, authorship is attributed in the reference section of the report. Certain other references have also been listed. These have been invaluable as general background, even though the content does not appear in the report.

PREPAREDNESS CLIMATE AND PERCEPTIONS

Much lip service is lent to the need for community preparedness. However, even the acknowledgment that a threat truly exists is often not sufficient to mobilize planners into action. Today we have a situation where the local community in general has not yet accepted the imminence of an earthquake disaster. And this is notwithstanding the two or more years of focused effort toward raising the threshold of public awareness. Is it surprising, therefore, that the chemical emergency is not viewed with appropriate concern—particularly in the light of the shallow understanding of this many faceted and complex threat? It is a fact that localized incidents do draw attention and even the immediate ire of a small affected community. But seldom, and only by a very few, is there an outlook beyond the immediate to what might occur, should the sudden confluence of circumstances and events trigger the unexpected. All this is not to say that perceptions are necessarily in concrete. They can be changed. But if this is the intent, the re-education must begin at the level of the policy makers and planners, where today there is no unanimity of thought regarding the need for additional and accelerated chemical disaster preparedness.

Ironically, the petrochemical companies do have a sense of urgency regarding safety, although it is generally in the context of rendering the plant environment safe for their employees. This points in the right direction but it also ends at the perimeter of the facility's property line. The major petrochemical companies tend to reflect more safety awareness than those in the smaller companies. However, this is a rule that is not universally applicable.

COMMUNITY DISASTER PLANNING

Community disaster planning is a continuous process but the continuance aspect must not be a shield behind which plans are permitted to become outdated and non-responsive to changing situations. Furthermore, the purpose of the plan is not to fuel the papermill but to convey relevant information and direction, educating both the planner and the recipients of the plan in the process. To the extent practical this means developing alternative scenarios clued to a spectrum of possible contingencies.

Public involvement in disaster planning is crucial, especially in terms of developing an awareness and knowledge of the planning being undertaken. Feedback from the public is necessary at all stages of the planning process. This requires that the public be kept fully informed about what is planned, especially with regard to those aspects which one foresees as potentially questionable. For a disaster plan to be effective, the community residents must know, understand and accept it.

The key element in implementing total community planning is the development of effective links between the various organizations within the cities and counties which would become involved in case of a widespread disaster. This does not mean simply a listing of tacit agreements for mutual assistance that are pegged to the lowest order of emergency. It means confronting in advance the harsh realities of a major disaster, however unlikely but still within the realm of possibility. One must bear in mind that if such a disaster should occur it will not be the result of ordinary circumstances. Planners should foresee such contingencies, set aside their concerns over competing domains and establish the framework for an effective operational response to whatever the situation.

As a rule, preparedness for natural disasters is generally the major responsibility of one organization--usually whatever is constituted to be the civil defense agency or the largest governmental entity in that geographical area. This responsibility means that the organization is the lead agency in calling attention to the range of hazards in the area; in coordinating the activities of other planning groups addressing these problems; and in prioritizing these efforts.

In the case of technological disasters generally, and more specifically sudden chemical disasters, we have been unable to identify any single organization which actively takes responsibility for coordinating these efforts in the SCAB. To all intents, there is none. Various government agencies are peripherally involved in preparations for disasters resulting from chemical incidents, but to have the authority to assess overall preparedness across county lines and enforce a rigorous standard of compliance with agreed standards. The local fire departments have a special interest in chemical hazards, and often a special competence, but they do not necessarily serve as the lead coordinating group in their own city, let alone in their county or the SCAB. Some local chemical plants, reflecting recent corporate direction, are becoming more involved in community disaster preparedness activities but, as noted previously, this involvement does not include the assumption of a lead role beyond their immediate plant boundaries. Thus, in the SCAB there is no single Czar-type organization with the responsibility and the authority to direct overall preparedness planning for potential chemical disasters.

In its various studies the Disaster Research Center found continuing evidence of what it termed "mutual ignorance" between organizations in the private and public sectors regarding their respective activities. The Center notes that the local fire departments are the major, and virtually the only, point of contact between local emergency organizations and chemical companies within an area. The narrowness of this linkage between the two sectors causes chemical companies to remain generally uninformed concerning community disaster planning. Similarly, most public safety agencies know very little about what the neighboring companies are prepared to do in a major chemical emergency.

A further serious complication is that often in-plant accidents are not viewed by the petrochemical companies as a legitimate concern until there is direct and visible impact on the community. Sometimes this is too late...or at least later than it should be. The recent Fiberite plant incident certainly points in this direction.

The lack of coordinated planning effort between the private sector and public organizations in chemical disaster preparedness is changing-but not rapidly. A fact brought out by the DRC studies is that "when chemical disasters occur in areas for which jurisdictional responsibility is unclear or complicated, (e.g., port or river areas) the pre-planning often has failed to reflect a clear delineation of responsibility. Even when there is disaster preparedness, there still will be gaps in coverage unless coordination is very tight. Whereas it is desirable to have petrochemical companies located away from built-up residential areas, these sparsely populated zones are sometimes meagerly serviced by the emergency organization in the community. Here you have a situation where the risk is low of an emergency occurring. But if it should occur, the response often is less effective than it should be." The reason for raising these issues is to highlight their complexity and make clear why there are no easy answers to the problem of coordination.

Professor E. L. Quarantelli of the Disaster Research Center brought to light some interesting paradoxes in the planning for chemical threats and dangers. Among the major ones, confirmed by our findings in the basin, are the following: "(l) Chemical facilities that engage the most in planning are not necessarily the ones that most need to plan." An example is the large safety-minded corporations who are becoming extremely sophisticated in their safety measures, as opposed to the smaller local companies. The latter often cannot afford elaborate safety planning and plant modernization, notwithstanding the need for both. "(2) Chemical companies tend to see accidents and catastrophies as points on a continuum and thus to see disaster planning as an extension of everyday safety planning. One consequence is that when an in-plant accident occurs, all energy is directed to containing and reducing the threat, and little to informing the community of the attendant hazards should the threat not be contained. In the event the containment efforts are not successful, the community suffers due to lost warning time. Also, lack of reporting tends to give a community a false sense of security. (3) The fire department, the most likely local organization to be the prime responder to a chemical disaster, is usually not involved in comprehensive planning beyond its own immediate role. (4) Planning for plant safety incidents or planning for disasters tends to be viewed as the same thing in most chemical companies. It is often unrecognized that there might be a qualitative difference in the planning necessary, and response required, for the two kinds of situations. Accordingly, preparedness which is excellent for accidents may lead to a mistaken belief of being prepared for disasters. (5) While pre-plan mechanisms exist for obtaining information and expertise, as well as mobilizing specialized personnel and equipment, the initial and prime responders to a chemical incident usually have major difficulty in simply identifying what, if any, hazardous materials are involved. This is especially true in transportation accidents where multiple chemical substances often are involved." Even with a manifest in hand, the first responder on the scene often is at a loss as to what remedial actions should be taken. Meanwhile, precious time is wasted. From all of this one can conclude that disaster preparedness for chemical emergencies has quite a few gaps that are perhaps tolerable in terms of localized incidents, but necessarily of serious concern if there should occur a major disaster impacting a large fraction of the SCAB. (See Reference #3.)

VERTICAL LINKAGES

We noted previously the problem of competing domains and loyalties which tend to hinder cooperative efforts across jurisdictional lines. Further to this point, K. J. Tierney, Ph.D., Department of Sociology, University of California at Los Angeles and Institute of Safety and Systems Management, University of Southern California, makes the point that "vertical linkages are extremely advantageous in terms of the resources they can mobilize in times of emergencies. However, from the standpoint of local organizations, instituting and maintaining these linkages for planning purposes can be costly in both time and effort." And this relates directly to the ever-tightening budgets...a consideration that is usually key to the availability of resources. Tierney further notes that "there is a tendency for organizations to resist any dilution of autonomy and control. The prospect of losing it to some outside entity at the time of a serious chemical incident is unwelcomed by most local organizations who see themselves as the ones who will bear the brunt of public indignation if an incident is mishandled. As a result, despite the availability of outside resources, there often is a tendency for organizational personnel to hope rather than to plan adequately. The rationalization is that money is being saved and autonomy is being preserved." One can appreciate the concern of local officials regarding any dilution of authority that is needed to effectively discharge responsibilities. However, the history of government, at its various levels, reflects precisely such accommodations, without which little would ever be accomplished. (See Reference #4.)

SPECIALIZED/COMPARTMENTALIZED PLANNING

In the SCAB, the petrochemical companies and the fire departments who serve them are the two best qualified organizations to cope with a chemical emergency and these are the organizations that do most of the planning. And this is not peculiar to the basin. Tierney confirms from her research that this is generally the rule. However, her study also notes that "most of this information and expertise is localized and remains within organizational sectors, not readily accessible to the larger community disaster preparedness subsystem."

According to Tierney, "specialization and compartmentalization have several ramifications for overall community disaster preparedness and response. First, while the specialized organizations know a great deal about the particular tasks on which they focus (neutralization of chemical agents, for example), there is a lack of mutual understanding about how other important tasks (such as evacuation) will be handled and who will carry them out. This lack of general pre-planning and consensus will make working together in an acute chemical disaster very difficult. Also, due to the jurisdictionally complex and compartmentalized nature of chemical emergency preparedness, gaps occur in planning. For example, communities with chemical facilities may have organizations with the knowledge, expertise and resources to handle emergencies at local chemical production facilities, yet there is no such clear cut delineation of responsibility for chemical transportation emergencies within the same jurisdiction. Or, certain disaster-related tasks, such as emergency medical care in a mass casualty incident, may either have been glossed-over or not adequately coordinated as part of chemical emergency planning. These deficiencies are unlikely to come to light during non-emergency times in communities where personnel charged with specialized preparedness responsibilities do not communicate regularly. A disaster drill involving the simulation of a major chemical emergency would surface these oversights. However, such drills are seldom conducted on a community-wide basis." The latter point is particularly relevant to the basin. Even when the drills are conducted, the element of realism is missing from the scenarios. Fire departments do, of course, have frequent drills and these often simulate "real time" contingencies. But, again, this relates to the localized incident, and not one across city and county lines of disaster proportions.

As Tierney points out: "None of this is to say that in taking an integrated approach to disaster planning one should ignore specialization. On the contrary, specialists are essential to an effective response. However, preparedness also involves sharing information and resources so that all potentially involved organizations cannot only anticipate the threats from the chemical agent, but also anticipate one another's actions in disaster, thereby avoiding conflict, duplication of effort, and inadequate response." Here in the basin one will readily find agreement with this in principle, and the principle works for localized incidents. Beyond these the planning and sharing are quite remote, probably because the major chemical disaster is not viewed as a likely occurrence. Cost inevitably is cited as a factor in not doing more along the lines of community preparedness. And one must acknowledge that this is a consideration. However, as Tierney indicates: "a relatively modest budget is sufficient to promote exchange of information among disaster relevant community groups, and to integrate preparedness for chemical emergencies with more general community disaster planning. Community risk assessments, community preparedness meetings, training sessions, and community-wide drills are all means to these ends." There also are some political discussions that need to be made and these are perhaps the most difficult of all. At the root of all this is a question as to what priority should be assigned. This should not be done in the isolation of any single community, because none of the communities can stand alone in the event of a truly catastrophic chemical incident. And so once again we return to the importance of integrated planning of a type that reflects the same realism one will confront in the case of a truly catastrophic chemical incident. (See Reference #4.)

COMMUNICATION

The two mechanical means of communication generally discussed are sirens and radio. Particularly in regard to warning, they are clearly most relevant if the forewarning period is relatively short. There is fairly clear evidence that use of warning sirens alone is inadequate to stimulate people to take immediate protective action. The sirens may not be noticed. If noticed, they may be ignored.

Radio and television are the most widely used, and potentially the most effective and efficient means of communicating warnings. They are widely accessible, not particularly vulnerable to environmental impact, highly flexible, immediate, and generally given high credibility by the public. Research data indicates that these mechanisms are frequently turned to by people in mass emergencies. It must be noted, however, that the effectiveness is to a considerable degree dependent on their operation being congruent with the decisions and activities of local officials. Lack of congruence confuses and compounds the dilemma for everyone.

In the past, an interesting dependence of local officals on radio and television has been noted in certain types of mass emergencies. In technological disasters, such as the Three Mile Island incident, the Louisville chlorine barge episode and in some recent chemical disasters in other parts of the country, important information was controlled by private or non-local government agencies and not always given directly to local authorities. In these instances, radio and television became the major source of information available to those who must make the key operational decisions.

In still other situations, radio and television may function in a more integrated role than is realized, intended, or planned. It has been reported that in four communities along the Mississippi River that were threatened by toxic gases--and in the absence of coordination and leadership by government agencies—radio stations assumed the responsibility for summoning expert assistance, determining risks, and making decisions regarding warning and evacuation that ordinarily would have fallen to local officials. The general public, realizing that the station was the only dependable source of information, listened to it extensively, believed it, and later reported high satisfaction with it.

During this survey one county official suggested another means of warning, i.e., the development of a telephone network whereby people could call one another to discuss and confirm warning and evacuation information. Experience has shown, however, that in the case of even a medium-size disaster the phone system quickly becomes overloaded and few calls in the later stages pass through.

We do know that the sheriff and police departments have made use of speakers to alert populations to danger and to urge evacuation. This is more effective during events that allow a certain amount of forewarning. However, there are very clear limitations based on the extensiveness of the area for which this type of warning system is intended. A related aspect of communication that bears further study is the lack of crossover capability among the various radio networks. This definitely hampers interagency coordination.

WARNING SYSTEMS

Responsive warning systems are a key ingredient in disaster planning. It is also a fact that many of our most vulnerable communities are not adequately prepared in this regard.

To estimate the cost of an adequate outdoor warning system, the Carson area was selected for survey due to its heavy concentration of industry harboring hazardous toxic materials. The assistance of the Signal Division of the Federal Signal Corporation was solicited in conducting this survey. An area was pinpointed bordered by Del Amo Boulevard on the north, Sepulveda Boulevard on the south, Figueroa Street on the west and Route 17 to the east. It encompasses the southern half of the City of Carson which is not now equipped with outdoor warning sirens. This site was selected by evaluating such criteria as population density, rural and urban development, geographical and topographical considerations, minimum performance requirements, power availability and economics.

If an emergency developed today requiring evacuation, the public would be notified by one, or a combination, of three methods: 1) mass media notification by either radio or television; 2) door-to-door notification by local authorities; and/or 3) outdoor warning and notification by an emergency vehicle driving up and down each street. All of these options would be time consuming and would tax local resources to the fullest. There would also be the possibility of mass confusion for the local populace.

For purposes of this survey, two types of outdoor siren warning systems were considered: 1) an electronic siren; and 2) an electro-mechanical siren.

The electronic siren system offers these advantages:

1. Immediate notification by day or night of all affected people that an emergency is in progress.
2. Public address capability to provide information as to the nature of the emergency, where to go, and what to do.
3. Seven distinct signals to distinguish the type of emergency.
4. Thirty-minute continuous operation following loss of primary power.
5. Westminster chimes signal to allow daily testing.
6. Distinctive electro-mechanical dual-tone sound to distinguish it from an emergency vehicle siren.
7. Status feedback upgrade capability to assure local officials that all sirens have been activated.
8. Ease of installation.

The installation would consist of electronic sirens with sound output ratings of 124dBC at 100 feet and 115dBC at 100 feet. For purposes of depicting anticipated coverages, an attenuation factor of 10dBC per distance doubled was employed. This produces a signal of about 68dBC at 4,800 feet for the 124dBC Federal Signal EOWS 612 sirens and 68dBC at 2,400 feet for the 115 dBC EOWS 1212 sirens.

The recommended types and locations of these electronic sirens would be as follows:

Siren #	Type	Location
1.	EOWS1212	Carson City Pool
2.	EOWS612	Scott Park
3.	EOWS612	Carnegie Jr. H.S.
4.	EOWS1212	Adams St.& Prospect Ave.

This system is priced at approximately $51,500, not including installation. The latter generally costs between two and three thousand dollars per siren site, depending on the siren.

The electro-mechanical siren system is capable of two emergency signals, "alert" and "attack." "Alert" is a steady signal and "attack" is an undulating (wailing) signal. The electro-mechanical system offers these advantages:

1. Immediate notification by day or night of all affected people that an emergency is in progress.
2. Low cost.
3. Field proven long-term dependability and maintenance-free.
4. Ease of installation.
5. Cancel function.

In this case, Federal Signal's RSH10A 122dBC siren, producing a signal of about 68dBC at 3,500 feet, and Federal's STH10A 115dBC, producing a signal of about 68dBC at 2,400 feet are recommended.

The recommended types and locations of these electro-mechanical sirens would be as follows:

Siren #	Type	Location
1.	RSH10A	Carson St. Elementary School
2.	RSH10A	Scott Park and Pool
3.	RSH10A	213th and Perry St.
4.	STH10A	Adams St. and Prospect Ave.

The above system is priced at $32,500, plus installation. Both the electronic and the electro-mechanical systems would utilize DTMF Radio Siren Activation. This would allow local officials the versatility of activating one siren, any combination of sirens, or all sirens. The possibility of accidental radio activation of a siren (falsing) by an outside party would be small for a DTMF radio control system. Both warning systems are designed to provide a minimum 65dBC intensity as the minimum signal level in the coverage area. Siren range for Carson was computed using a 10dBC per distance doubled attenuation factor. This value takes into account all factors that affect the signal and provides realistic coverage expectations.

The main determinant for a local agency as to which siren system to choose, electronic or electro-mechanical, is the primary objective of the siren system itself. The siren system is just a part of the local emergency plan. If siren activation means that an emergency is in progress and that the local citizens should turn on the radio, an electro-mechanical system is sufficient. However, if one foresees many different types of emergencies, and there is a need to be more specific as to type in terms of the appropriate response the citizens should take, electronic sirens would be the better choice. Other determinants include many types of primary power available, whether the loss of primary power is a problem, the number of visitors who frequent an area, and economics. Nevertheless, both types of sirens would be adequate to help warn local communities that an emergency is in progress. In sum, the key factors driving such an expenditure are an estimate of the threat, in terms of required warning time, and the size of the geographic area associated with the threat.

EMERGENCY OPERATING CENTER

Direction, control, and warning are key functions of emergency preparedness and response operations. A central facility from which all emergency efforts can be coordinated and directed is considered by the Federal Emergency Management Agency (FEMA) as essential for emergency response and recovery, whether the disaster stems from natural or man-made causes, or from an act of war. Such a facility is referred to as an Emergency Operating Center (EOC). The EOC also has an important role when realistic simulations of disaster situations are conducted, serving as a physical framework for bringing the "decision-making" organization together, thereby promoting an integrated, team-building approach to disaster management.

The design and capability criteria are somewhat stringent. However, to a degree, these can be tailored to the needs of a specific community. Certain cities in the SCAB have taken the initiative and established a local EOC. This reflects, in a very tangible way, the priority that is being given to disaster preparedness by local officials. For the SCAB, there is a minimum requirement of one EOC per county, and it must be in conformance with the standards prescribed by FEMA if it is to fulfill its function.

EMERGENCY BROADCAST SYSTEM

In response to a Federal Communications Commission (FCC) request, the Los Angeles County Emergency Preparedness Commission developed an Emergency Broadcast System (EBS) plan in 1981, and it was approved by the Board of Supervisors in June of that year. The purpose of the plan was to provide a communications channel between local agencies and the public in the event of an emergency occurring in Los Angeles County. The system is voluntary, and involves the cooperation of various county and city agencies and the local media. It is an excellent system for Los Angeles County and merits consideration as a model for bringing the other basin counties into the network.

The system utilizes 39.98 MHz frequency (which the SCAQMD uses to broadcast smog alert information to schools and industries) which normally has minimal traffic.

Emergency broadcasts can be originated by an appropriate local government representative, by the Mayor, Chief of Police, or other designee of the City of Los Angeles, by the Los Angeles County Sheriff, Chairman of the Board of Supervisors, or other designated County representatives. The Sheriff is responsible for the content and authenticity of the broadcast information. EBS facilities are located at the Sheriff's Department Radio Center, at the Sheriff's Information Bureau in the Hall of Justice, at L.A.P.D. headquarters, and at the Los Angeles Emergency Operations Center at City Hall.

An emergency must affect a significant segment of the population before information can be broadcast over the EBS. There is no written definition of what constitutes a "significant segment." This would be determined on an ad hoc basis by the Sheriff's Department. At the minimum, it should affect the citizens of several cities, or a wide portion of Los Angeles. All emergency messages are sent by telephone to the Sheriff's Information Bureau at (213) 974-4211. The authorized city or county representative may prerecord messages, telephone or personally deliver live messages, or have the Sheriff's Department redeliver the message verbatim. The City of Los Angeles, after clearing its message with the Sheriff's Department beforehand, can broadcast its own message. The message is broadcast over the 39.98 MHz frequency to receivers located at 22 radio stations and 8 television stations. The stations are alerted beforehand that an EBS message will be sent. Upon receiving the message, the stations have full discretion to broadcast verbatim or edit the message.

The editorial discretion of the stations is crucial to the success of the EBS. This enables the stations, all of which have news departments, to broadcast only those messages they deem necessary. This heightens the impact of an EBS message, better assuring it will be listened to when broadcast. It is essential that the urgency of an EBS message be maintained; thus the media broadcasts an EBS message only when urgency truly warrants it.

The EBS is not meant to be a "news flash" system informing the public that a disaster has just occurred. The radio and TV stations have field reporters which get to the scene in minutes to broadcast late-breaking stories. The EBS is meant to be an advisory system which will inform the pubic what to do in response to a disaster. By the time the EBS message is broadcast, the media should have already aired the initial newsbreak. The EBS is intended to be broadcast shortly thereafter, as soon as the message content is verified. Confusion or misinformation would definitely undermine the effect of the EBS.

EBS is a rapid and effective method of disseminating advisory information to the public with several distinct exceptions. For example, if a toxic disaster occurred during the early morning hours, most TV's and radios would be turned off and the message would not be heard. The EBS has no way of alerting the public to turn on their radios or TV's to hear the message; it can only alert them to the fact that a message will be broadcast if their sets happen to be turned on. In Canada, the EBS automatically dials peoples' telephones to tell them that a message will be broadcast shortly. This is facilitated by the fact that the media and telephone companies are nationally owned there. However, a similar system here would be impractical and expensive to implement.

This EBS serves only Los Angeles County. The other counties do not utilize the 39.98 MHz frequency for their emergency planning, although this frequency ties into 30 major radio and TV stations. The Orange County plan utilizes radio stations located within the county, but these are small and have limited range and listening audience. Similarly, neither Riverside nor San Bernardino Counties has quick access to the major networks to broadcast their emergency messages. Such access would benefit each county individually, and would also provide the broader coverage to all counties in the event a major disaster impacted across county lines.

EVACUATION

We know that a key element in emergency preparedness is the ability to evacuate. This is a fact whether the emergency is of a localized nature or with broad impact across city and county boundaries. Particularly in the case of a chemical disaster, timeliness is a key consideration. According to one authoritative source, Prof. E. L. Quarantelli, of the Disaster Research Center, an orderly, planned evacuation can also serve to reinforce morale insofar as it strengthens the belief among our citizenry that competent authorities have indeed taken charge.

In his studies, Professor Quarantelli has noted that the initial withdrawal phase of the evacuation process usually proceeds relatively well. "The departure tends to be orderly, reasonable from the perspective of the evacuees, and generally effective in removing people from danger. Most of the problems with evacuation occur before and after the process takes place."

Today, in the SCAB, there is no evidence of organizational preparedness for initiating and conducting mass evacuation in the event of a major technological disaster. We refer here to situations where large segments of a county, or counties, are instantaneously and simultaneously threatened by major toxic emissions caused, for example, by an earthquake or sabotage. This is an entirely different scenario than one where even ten thousand people, in a relatively circumscribed area, are evacuated due to a single, localized incident.

Today, evacuation is not treated as a major policy matter. Perhaps even more fundamental, most disaster preparedness officials regard the possibility of a mass evacuation under a worst-case scenario as remote. Hence the reluctance to accord this contingency an appropriate priority. However, remoteness is not the issue. The question more appropriately is whether this possibility, even if remote, can be disregarded in the overall planning framework.

There are some other factors that often fail to receive proper attention in evacuation planning. For example, little attention is given to the distinctive features and special problems which can be involved in mass evacuations due to a chemical emergency at varying times of the day and night in a basin where transportation arteries are few and congested. It is not unusual to find this situation. Professor Quarantelli, and other researchers who have studied the evacuation phenomena, repeatedly make the point that "whether in plans or in actual instances, little consideration is given to the fact that evacuation involves going to some area, as well as movement from some locality, and inevitably a return to the original point of departure. To ignore the directed and round-trip nature of the evacuation process is to miss much of what must be dealt with in practical terms."

Another point made in the DRC studies is that often there is a reluctance by some to evacuate--for whatever the reason. Yet, in the event of a chemical disaster, timing is key. And if the incident is of major proportions, affecting widely dispersed areas, those who have not been indoctrinated beforehand in evacuation procedures, are not about to react with speed and cooperation during the crisis.

Based on the above, the following are some general guidelines that have been extracted from DRC studies and which provide a basis for preparedness planning. "First, evacuation should be approached as a proactive policy, distinctive and important in itself." This means realism in the planning stage and in conducting pre-emergency exercises. "Second, planning should visualize evacuation as a flow process with different emergent stages involving various types of contingencies. Third, operational personnel should consider the full range of behavior patterns involved in evacuation from the warning, to the withdrawal, to shelter, and then to the return stage." Management of a large scale evacuation requires considerable fine-tuning and some of this must be thought out in advance.

Experience, documented in various DRC studies, emphasizes that the evacuation plan is the only framework. Those responsible for the effective execution of the plan must act in an informed, coordinated manner. Otherwise, confusion will reign and the situation will readily evolve out of control.

Another point emphasized in past research is the importance of maintaining open lines of communication to the evacuees by responsible emergency authorities to guard against precipitous return to the impacted area or similar actions which complicate the evacuation process. This not only requires planning but also the exercise of these plans under conditions that closely approximate a true chemical disaster environment. (See Ref. #5.)

EMERGENCY MEDICAL SYSTEM

We acknowledge that some planning and operational personnel believe that the everyday Emergency Medical System (EMS) system can simply be extended in mass emergencies with assurance that it will perform adequately. However, past experience, documented in DRC research findings indicate indisputably that "mass emergencies create demands that differ qualitatively and quantitatively from everyday EMS needs. For example, disasters can create a large number of walking wounded who, while not necessarily requiring the services of a hospital emergency room, may nevertheless intensify demands by converging on hospitals." (See Tierney-Taylor Ref. #6.)

This is particularly true in the case of a large scale chemical disaster where patients descend on hospitals without prior diagnosis.

Another difference between disaster and everyday EMS noted in the referenced study is that "everyday EMS is designed to function with great speed in meeting specialized problems of sick and injured individuals, e.g., cardiac arrest and multiple trauma. Whereas, in disasters which produce large numbers of casualties whose medical problems exhibit different degrees of urgency, speed of the response may not be crucial to effective operations. Instead, the overall coordination of the response among hospitals, and between first responders, becomes the essential task."

The Tierney-Taylor study notes "a widespread lack of knowledge about the EMS in most communities." Here in the basin we find adequate information about, and satisfactory execution of, the day-to-day EMS. However, much remains to be done with regard to coordination if these services are to be effective in a mass casualty situation. The following quote from the referenced study describes the basin situation perfectly: "Where mass emergencies are concerned, attitudes of either faith or fatalism are prevalent. On the one hand, there is faith that the necessary assistance will be forthcoming from some quarter in situations of extremely high EMS demand; on the other, there is a fatalistic notion that for some disasters there probably can be little effective community response."

It is understandable why interorganizational coordination is not easy to achieve. The same political considerations that are documented in the vast literature of DRC studies on EMS apply, in large measure, to the basin as well. While some will cite the vast resources available in the basin that could be applied in the event of an emergency, this avoids the questions as to whether or not there has been adequate planning for the effective application of these resources. Those who recall and participated in the WATTS emergency some years ago will suggest that many of the same EMS problems remain with us today.

Additionally, mass emergencies (particularly those resulting from earthquakes) would not necessarily be limited to a politically convenient location in the SCAB. Any number of organizations and agencies, on a variety of governmental levels, would have an operational role in case of a major catastrophe. One can readily foresee how overlapping jurisdiction could lead to confusion in the delivery of services, and to treatment of patients in less than a satisfactory manner. Hence, the overriding need for coordinated planning.

We know "the plan" is key. This must include coordination and also periodic exercises simulating worst-case situations. In this regard, the referenced DRC study makes several additional points that bear repetition here: "a) planning must include major input from physicians and nurses experienced in emergency treatment. b) Hospital delivery must also be based on patient medical needs, not on the desire of the hospital to receive them and the availability of an ambulance to bring them. Thus, professional medical input, early in the process of determining policy and objectives, is an imperative in MCI planning. c) The actual formulation of the logistical and operational plan should be the responsibility of the providers. Essentially, it is the public safety people who should develop the coordination of resources and all that that entails."

We know from experience and other DRC studies that an MCI response utilizes a heterogeneous array of organizations including police, firefighters, ambulance personnel, (sometimes) civil defense personnel, nurses, physicians and hospital administrative people, plus other public and private organizations. If these groups have not found a mechanism to work together harmoniously in the planning stage, it is unrealistic to expect everything coming together under the stress of emergency. Unfortunately, the approach taken in many situations where agreement is anticipated to be difficult is to simply ignore the problem. However, the basic differences remain only to surface again at the most inopportune time.

In the recommendations section of the report we will note a number of the areas that require careful study, planning and coordination. These will not be repeated here except to stress one key area--"exercises." Exercises are the most effective method of testing logistics and coordination. They provide opportunity to identify the gaps and solidify relationships. The latter is of overriding importance due to the benefits that can conceivably carry over back to the planning table. Exercises, however, must be held with some regularity, otherwise they are relatively meaningless. And the lessons learned must be applied to future planning--otherwise the longer term benefit is nil. As other studies have noted, the exercise scenario is key. It must be realistic--not just convenient. Also, it should anticipate the unexpected. Otherwise, we are exercising robots with no memory beyond the original limited prolimited programming. There is a tendency to regard community disaster drills as an annual or biennial event, approximating a square-filling exercise. The hallmarks were aptly described by one researcher as no imagination, no diversification, no enthusiasm, and only junior-level participation. Clearly more attention must be given to this element. This means more interest from the top of the response structure. (See Ref. #6.)

ASSESSMENT BY RESPONSE SCENARIO

In the course of our survey on EMS response, we met with Dr. Doug Arterberry, Director of the Northridge Tox Center and with Mr. Eric Hutchins, a systems analyst, who is working closely with Dr. Arterberry in developing a flexible, computer-based incident reporting system. As a result of our meeting, a step-by-step scenario was proposed that would permit a realistic assessment of EMS response in the SCAB.

First, identify a manageable number of locations (say five to ten) where a major incident is most likely to take place. This could probably be worked out by cross-referencing such factors as the amounts of hazardous materials stored at various locations, the numbers of fixed containers in which the materials are stored, and their respective incident histories (number and severity). Care should be taken to insure that at least one of the sites selected is located in each major area of concern.

Second, work with the Medical Alert Center (MAC) to develop quick emergency response scenarios for each site. This need be nothing more than a casualty profile in hard numbers, a list of the first tier of agencies to be called, and a sequence of the initial things each of these agencies would do.

Third, contact the agencies listed by MAC for each of the likely incident locations and invite them to be represented at a meeting to discuss the scenario. At the meeting, describe the incident, the casualty profile, and MAC's rough idea of what would happen in the beginning of the response. Let the discussion flow from there and carefully record the areas of consensus, difference, and ambiguity.

Fourth, conduct whatever analysis and further interviews may be required and send a copy of the draft report to each agency that was represented, along with an invitation to a debriefing and further discussion.

The above approach permits a relatively quick and accurate assessment of what should happen and what is needed in the way of preparation from a medical standpoint. Roughly the same approach could be taken in evaluating other aspects of preparedness.

Another area identified as worthy of closer examination was how use of some self-contained computer work stations at the MAC, and at the critical response agencies, could shave minutes (perhaps hours) off the critical first phase of response. For example, when the first alert notification comes into the MAC, the area scenario checklist, that was begun in the course of the assessment, could be brought to the screen immediately. This checklist could include agencies to be notified and lists of contact persons to ascertain the status of critical resources in the private sector. None of this information will take the place of the response experts at the MAC, but it will support them with months of preplanned information thoughtfully put together by teams of people.

In order to positively identify the substance or substances at a given site, the inventory record of what chemicals are stored at that location could be brought to the screen by the local fire department. This information could be telephoned to a central Tox Center (such as Northridge), along with the first substance description from the scene. The Tox Center could immediately advise the MAC and scene commander regarding the fastest route to positive chemical identification and to personnel protection. The Toxic Center could download a record of the substance from its HAZMAT database to hardcopy and have it flown to the scene commander. The Toxic Center would then go on-line to the Chemical Information Service (CIS) and to the National Library of Medicine (NLM) which would download their respective records on the substance for further interpretation and advisement to MAC. The scene commander could have a microcomputer at the scene to provide direct communication with the Toxic Center; to act as a casualty record center; and to serve as a displaced persons message center. This would enormously simplify the subsequent tasks of incident tracking, damage reporting, and reuniting separated family members. The software for everything listed above presently exists or can be created with minimum expense. The hardware for a reliable mobile operation also exists.

Both projects detailed above are examples of what can be beneficially accomplished on a comparatively low budget, and in a realistic time frame. What is needed is more centralized control over planning; the initiative and ability to identify and integrate such efforts; and the authority and determination to set priorities, make commitments, and follow-up to be sure they are met.

INTEGRATED PLANNING

Integrated emergency planning need not be a difficult process. However, it takes thought, time, and continuous updating. FEMA has spelled out the process in its various publications. Eventually, it begins with a comprehensive hazard assessment prepared by the community, possibly in conjunction with state and federal regional personnel, depending on the circumstances. It then proceeds through an analysis of capability, identifying shortfalls of resources, and moves to the development of a generic operational plan with annexes for the unique aspects of individual emergencies, the maintenance of capability, mitigation activities, emergency operations, and evaluation of such operations. The jurisdiction will then prepare a multiyear development plan, followed by annual plan increments as the process proceeds. A very key element is the intra- and inter-jurisdictional coordination to be certain that all the players recognize, and are able to execute, their responsibilities if put to the test. By following this process, a community can establish an emergency management system, with readiness to deal with both the common elements of preparedness and those requirements which are unique to individual emergencies. There are a few shortcuts that perhaps are practical in certain situations. But anything that deviates significantly from the above results in something significantly less than integrated planning.

FINDINGS

Community preparedness is today adequate if evaluated in terms of capability to cope effectively with a localized chemical incident. This includes evacuation of a major segment of population from a single designated area. (The recent Larry Fricker Co. incident is a case in point.) The one exception to this favorable assessment is in the area of training and equipping HAZMAT team personnel. Some improvement is needed on both counts. The reason for this generally encouraging assessment is the exceptional competence and esprit which characterizes the state of readiness of fire department personnel located in the more critical areas of the basin, i.e., critical from the standpoint of vulnerability to a major toxic chemical incident. Were it not for the high degree of training and professionalism evidenced by these personnel, the overall threat would increase dramatically and hence reduce our estimate of the community's ability to quickly and effectively respond to a severe localized incident.

Community preparedness is today not adequate if evaluated in terms of capability to effectively cope with a chemical disaster of Bhopal proportions, whether caused by earthquake, sabotage or otherwise. This scenario foresees large segments of a county or counties being simultaneously impacted by toxic emissions causing instantaneous and widespread damage. Some progress is being made toward adequate prepardness for a major disaster. Considerably more remains to be done. If the timetable is to be accelerated, preparedness priorities must be revised. In the present climate of budget austerity and parochial thinking integrated planning, however essential, is not a realistic possibility.

RECOMMENDATIONS

The recommendations that follow are categorized as: (a) Those actions that appear within the purview of the SCAQMD Governing Board for implementation; and (b) Those actions that may more appropriately require county or state level involvement.

SCAQMD Actions

1. The SCAQMD should serve as a catalyst and coordinator in facilitating a dialogue among industry, neighboring communities, and local disaster preparedness officials aimed at allaying concerns and fostering more cooperation. A prime target for this assistance is small businesses which lack the know-how and the internal organizational structure to take these

initiatives, yet would be favorably disposed to follow the lead of an overall coordinator. This form of cooperation could readily carry over into the emergency planning area and result in an integration of effort well beyond where we are today.

2. The SCAQMD Governing Board should adopt a resolution urging each County Board of Supervisors to enact an umbrella-type "right-to-know" ordinance, which could then be implemented by the cities on an as-needed basis; (b) Adopt a resolution supporting CA. Assembly Bill 2185, introduced by Assembly Members Maxine Waters and Willie Brown, particularly with regard to the requirement for disclosure of toxic materials information. It is fundamental that unless toxic chemicals can be identified by name and location, their control is, at best, difficult. This lack of information increases the risk for first responders to a toxic air emission or spill, and renders more likely adverse impact on a community due to delay in the identification of a specific chemical agent.

Today, the environment is right to get this legislation passed. Industry may not prefer it, but neither will it choose to risk the attendant adverse publicity that would result from any concerted opposition. Of the 197 companies that we surveyed, all but one readily cooperated. Even this company eventually provided its inventory of toxic chemicals. Two companies claimed their information was proprietary, yet made full and prompt disclosure once given assurance that the data would be appropriately safeguarded.

The one negative associated with this issue is the cost to cities and counties of maintaining the inventory in a current status. However, the overriding consideration is that the rapid retrieval of this information significantly impacts safety. Hence, those who must respond to disasters, and the communities that are affected by them, speak with one voice in urging the enactment of "right-to-know" ordinances.

County/State Level Actions

1. Single Point Preparedness Authority

Effective community preparedness for mass disaster situations requires: (a) An outlook that views the SCAB as a totality rather than as a loose confederacy of counties and cities; and (b) An agreement that integrated preparedness planning move forward on an expedited basis. Hence, it is recommended that a single point preparedness Authority be appointed–preferably a State agency with representation in the SCAB–which would have the responsibility and the concurrent power to ensure that all jurisdictions work together in developing, and periodically exercising, disaster preparedness plans as they pertain to both natural and technological disasters. The proposed Authority could operate through a small working committee with representation from each county, from industry, and from special agencies such as the SCAQMD. This structure would not usurp the prerogatives of local governments, but it would bring to their attention areas where gaps in preparedness exist, particularly those that relate to intercounty support. This, hopefully, would also result in counties moving more expeditiously toward getting their own house in order.

What follows is a listing, by preparedness area, of issues to be resolved, or at least more fully coordinated. It is proposed that these actions become part of the charter for the recommended single point preparedness Authority.

a. Emergency Medical Response System

Remedies must be found for the following: (1) an inadequate communication and command system to tie resources together; (2) not enough triage personnel; (3) insufficient nurses and paramedics; (4) lack of centralized dispatching of medical assistance; (5) insufficient emergency room, hospital, and clinic facilities to accommodate the critically and noncritically injured; (6) insufficient, and not readily available, data on the antidotes and treatments for those injured by chemical agents; and (7) absence of periodic and realistic full-scale mass casualty drills, simulating a Bhopal-type disaster.

b. Evacuation Plans

These plans should be revised to specifically incorporate a large scale chemical disaster scenario and to accommodate considerations outlined under the Evacuation section of this report. The information should then be broadly disseminated to all communities in the SCAB.

c. Emergency Broadcast System

Counties should develop an Emergency Broadcast System for their particular area, patterned after the L.A. County EBS. This would enable all counties to directly access the radio broadcasters and TV stations in Los Angeles, and thereby air advisories simultaneously within all four counties, or within whatever fraction of these counties that may be affected by a major disaster. Under this proposal, the 39.98 MHz frequency is a logical candidate for use by the counties.

d. *Emergency Operating Centers*

One fully operational EOC per county is a mandatory requirement based on the multiplicity of threats in the basin under which such a resource would be activated. An inspection authority, independent from the County, should periodically check the emergency operating centers to insure compliance with FEMA specifications and direct that discrepancies be corrected as a matter of priority.

2. *Industry Preparedness Plans*

Each petrochemical plant should be required to prepare and submit for review, a comprehensive disaster emergency plan for its facility. The plan should cover a spectrum of possible contingencies, to include toxic chemical emissions resulting from earthquake and sabotage. There should be a further requirement for periodic update. The single point preparedness authority in the SCAB would determine who should perform the review and standardize the procedure.

Also, industry should expand its contacts within the disaster preparedness community. Today, these contacts are almost exclusively limited to the fire departments.

3. *Assessment by Response Scenario*

The two exercises proposed in this report (pages 41-43) are a reflection of the vast resource of competence, ingenuity, and dedication available among the professionals in this basin. Both Dr. Doug Arterberry and Mr. Eric Hutchins have a realistic feel for what it takes to bridge some of the gaps in EMS planning. It is strongly recommended that the exercises they have proposed be undertaken as a starting point for any review of EMS activity. The Northridge Community Hospital does not have the resources to undertake these pilot studies in isolation. Therefore, there is need for a central Authority to seek additional support and make the appropriate commitment.

CONCLUSION

We acknowledge that there are no easy solutions to the problems of safety and preparedness. But neither can we lose sight of the fact that we today live in an environment, aptly described by one journalist, as perfectly legal and unbelievably dangerous. In this basin that potential for danger is certainly with us in abundance. Regardless of what course is chosen regarding these recommendations, Charles Perrow perhaps said it all and said it best when he commented that "sensible living with risky systems means keeping the controversies alive, listening to the public and accepting the essentially political nature of risk assessment." Ultimately the issue is not risk, it is the exercise of power-that same power derived from the consent of the governed.

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ACKNOWLEDGMENTS

As noted earlier, the data reflected in this report was drawn from myriad sources, i.e. state and government agencies, local emergency response agencies, the private and public sectors, the academic community.

We found invaluable the research efforts and insights shared with us by such acknowledged experts in their area of specialization as Professor E. L. Quarantelli and Professor Russell Dynes from the Disaster Research Center; Kathleen J. Tierney, Ph.D., Department of Sociology, University of California at Los Angeles, and Institute of Safety and Systems Management, University of Southern California; Ira Zimmerman, Ph.D., from New York University; Stanley Dolins, Ph.D., from the Nuclear Regulatory Commission; and John D. Arterberry, M.D., from the Northridge Community Hospital.

We also take note of the cooperation and courtisies extended us by the Elsevier Scientific Publishing Company, Amsterdam, the Netherlands which publishes the Journal of Hazardous Materials.

Finally, we acknowledge as our primary source of information the practical, day-to-day experience shared with us by those who serve "on the line"–particularly the fire, sheriff and medical personnel with whom rests the ultimate responsibility for translating plans into action.

To all of the above we offer our gratitude.

Appendix A

COMPANIES SENT HAZARDOUS MATERIALS QUESTIONNAIRE

Aerojet Ordnance Company
Air Products & Chemicals, Inc.
Industry
Air Products & Chemicals, Inc.
Long Beach
Alflex Corporation
Allied Corporation
Allied Kelite Products Div.
Alpha Resins Company
American Pharmaseal Laboratories
Amoco Chemicals Corporation
Amvac Chemical Corporation
Anabolic, Inc.
Angeles Chemical Company
ARCO Battery Manufacturing Co.
Armstrong World Industries, Inc.
Ashland Chemical Company
Santa Fe Springs
Ashland Chemical Company
Montebello
Atlantic Richfield Company

Baron-Slakeslee, Inc.
Bauer Coatings & Chemical Co.
B. F. Goodrich Chemical Company
Bordon, Inc.
Boyle-Midway

Cal Compact Foods, Inc.
California Sulphur
Calsol, Inc.
Cargill, Inc.
Carny-Chemical Company
Carrasco Vacuum Truck Service
Celanese Specialty Resins
Champlin Petroleum Company
Chase Chemical Company
Chem Lab Products
Chevron Chemical Company
Chevron USA Refinery
Chili Products Company
Ciba-Geigy Composites Division
Cine-Tech, Inc.
Cintas Uniform Corp.
City Tank Line, Inc.
Clorox Company
Coast Detergents, Inc.
Cominco American, Inc.
Consolidated Film Industries
Continental Chemical Company
Continental Graphics
Cool Transports, Inc.
Coral Chemicals, Inc.

Coral Chemicals, Inc.(tank farm)
Cosden Oil & Chemical Co.
Crescent Warehouse Co.
Cyclo Products, Inc.

Data Products Corporation
Deepwater Chemical Co.
Delco Remy Div., General Motors
Deluxe Lab., Inc.
Dexol Industries, Inc.
Diamond Tanklines & Transportation
Douglas Aircraft Company
Dow Chemical Company
Duncan Battery Co.

Eastman Kodak Company
Economics Lab., Inc.
Edgington Oil Company
Electro Bleach Products
Emery Industries
Essex Group, Inc.
Estee Battery Co., Inc.
Ethyl Corporation

Farm-Aid, Inc.
Ferro Corporation
Fletcher Oil Company
Flo-Kem Products, Inc.
FMC Corporation
Foto-Kem Industries, Inc.
Four Corners Pipeline Co.
Four Star Chemicals, Inc.

Garden State Paper Co.
GATX Storage Terminals Corp.
General Battery Corp.
Getty Synthetic Fuels, Inc.
Golden West Refining Co.
Goodwin Chemical Co.
Grow Chemical Coatings Corp.

Harbor Terminal Service
Hatchco
Henkel Corporation
Hill Bros. Chemical Co.
H. J. Baker & Bro., Inc.
Hugh J. Resins Co., Inc.
Huntway Refining Co.
Hyperion Waste Water Treatment Plant

Industrial Bettery Engineering, Inc.
Industrial Waste Engineering
Inmont Corporation
International Paper Co.

J. C., Inc., Liquid Waste Disposal
J. C. Penney Co. Drapery Cleaning
Johnson Controls, Inc.
Jones Chemicals

Keysor-Century Corporation
Koppers Company, Inc.

Lever Bros. Company
Lilly Industrial Coatings, Inc.
Liquid Air, Inc.
Long Beach Oil Development Co.
Los Angeles County Sanitation Districts Carson
Los Angeles Soap Company
L & N Uniform Supply Company
Lunday-Thagard Oil Company

Macmillan Ring-Free Oil Co., Inc.
McKesson Chemical Company
Merit Group, Inc.
MGM Lab., Inc.
Micro-Biotrol, Inc.
Mobil Chemical Company
Mobil Oil Corporation
Modern Coverall & Uniform Supply
Monsanto Company
Movielab-Hollywood, Inc.

Nalco Chemical Company
National Chemical Corporation
Neville Chemical Co., Chlorinated Products
Neville Chemical Co.
Newhall Refining Co., Inc.
Niklor Chemical Company
North American Environmental
Northrop Corporation

Oakite Products, Inc.
Oil & Solvent Process Co.
Omega Chemical Corporation
Orange County Chemical Company
Orange County Water District Fountain Valley
Owens-Illinois, Inc.
Ozalid Corporation

Paramount Petroleum Corporation
Pervo Paint Co., Inc.
Petrolane, Inc.
Petrolane Lomita Gasoline Co.
Pharmavite Pharmaceutical Corp.
Phillips Oil Company
Pilot Chemical Company
Poly Resins
PPG Industries
Proctor & Gamble Manufacturing Co.

Products Research & Chamical Corp.
International Polymer
Prudential Overall Supply Co.
Riverside
Prudential Overall Supply Co.
Van Nuys
Purex Corporation

Quemetco, Inc.

Reichhold Chemicals, Inc.

Shell Oil Company
Silmar, Div. of Sohio Chem. Co.
Sinclair Paint Company
Sloan's Dry Cleaners
Solder Plus
Southern California Chemical Co.
Southern California Edison, Colton
Southern California Edison, Redondo Beach
Southern California Gas Company
Space Age Chemicals
Spectra Color Lab., Inc.
Stapelton Company
Stauffer Chemical Co., South Gate
Stauffer Chemical Co., Carson
Stepan Company
Sterilization Services of California

Technicolor Corporation
Teledyne Battery Products
Texaco, Inc.
Texaco, Inc., Montebello Research Lab.
Textile Rubber & Chemical Co.
Timco
Toxo Spray Dust, Inc.
Trojan Battery Company
TRW

Union Carbide Corporation
Solvents & Coatings Materials
Union Carbide Corporation
Emulsion Systems
Union Carbide, Linde Div.
Fontana
Union Carbide, Linde Div.
Ontario
Union Chemical Div., Union Oil
Union Oil Company of California, Wilmington
United Chemical & Supply Co.
Upjohn Company
U. S. Borax & Chemical Corp.
U. S. Industrial Chemical Co.
U. S. S. Agri-Chem, Inc.

Waste Disposal Services, Inc.
Watson Biogas System

Western Disposal Company

Western Fuel Oil Company

Western Sulphur Company

West Newport Oil Company

Whittaker Corp., Bermite Division

Wilmington Liquid Bulk Terminals

Witco Chemical Corporation

World Industries International, Inc.

Wyle Lab

Appendix B

South Coast
AIR QUALITY MANAGEMENT DISTRICT
9150 FLAIR DRIVE, EL MONTE, CA 91731 (213) 572-6200

SAMPLE LETTER TO COMPANIES

February 1, 1985

*
*
*
*

Dear *

The recent disaster in Bhopal, India, focused world attention on the potential for calamity from the accidental release of toxic air emissions. I believe the safety record of the American chemical and energy industries is impressive. However, in the wake of the Bhopal tragedy, a national priority has been accorded--both by government and industry--to a review of the potential for similar accidents in the United States.

Based upon a cursory review of our local situation, the South Coast Air Quality Management District has concluded that:

- A Bhopal-type incident, though less likely here, cannot be ruled out as a possibility.
- Current contingency plans are oriented primarily toward the localized emergency and may not be adequate to cope with a disaster requiring mass civil notification and evacuation.

Accordingly, the District's Governing Board, with the support from state and local authorities, has directed that a study be undertaken addressing both the state of accident prevention and the state of emergency response within the South Coast Air Basin. The study's focus is on the major catastrophe-type incident and will consist of two concurrent phases:

1. A prevention and response assessment of industrial stationary sources, to include data gathering and select on-site surveys.
2. An assessment of state and local contingency plans relating to community preparedness in the event of such a catastrophe.

This letter is intended to inform you of our study, to solicit your assistance and support, and to stress the importance of a timely response to our request for data. Specifically, I am requesting that the attached questionnaire be completed and returned to my office by February 28, 1985. (Similar inquiries for data have been sent to appropriate state/local agencies to ensure that our data base is adequate and truly representative of the South Coast Air Basin.) We have worked closely with industry representatives in its preparation to ensure that the release of the information to us in no way compromises any trade secrets or proprietary information that we recognize must be protected. Also, we are aware that agencies of the state and federal government may later conduct separate inquiries on a broader aspect of this subject. To the extent practicable, we will coordinate this effort with such agencies to avoid needless duplication and inconvenience to you.

I reiterate the importance of a timely response to ensure that your company has been appropriately represented. In making this a cooperative effort, rather than one done in isolation with fragmented and possibly outdated information, your interests and those of communities within the District will best be served.

If you have any questions regarding the study or questionnaire, please contact either Mr. Gene Calafato (818/572-6451) or, in his absence, me at (818/572-6400). Thank you for your cooperation.

Very truly yours,

J. A. Stuart

J. A. Stuart
Executive Officer

JAS:pmj

Attachment

Appendix C

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

HAZARDOUS MATERIALS SURVEY QUESTIONNAIRE

PART A: GENERAL COMPANY INFORMATION

Facility Name: ______________________ Date: ______________

Facility Location: ____________________ Phone: ( ) ____________

Company Name: ______________________

Parent Company: ______________________

Type of Plant: (i.e., petroleum refinery, metal-plating shop, etc.)

____

(Please give a brief description of your plant. The materials you make, the processes used, when plant was built. Please use a continuation sheet if required.)

SIC No.: ______________________________

Name of Primary Contact Person: ______________________

Address: ______________________________

Phone: ( ) ______________________________

Title: ______________________________

Name of Alternate Contact Person: ______________________

Address: ______________________________

Phone: ( ) ______________________________

Title: ______________________________

PART B: HAZARDOUS MATERIALS INFORMATION

1. **Materials Inventory**

Attached is an inventory of materials considered immediately dangerous to the life and health of the general public if present in the atmosphere at levels of 2,000 ppm or less. Please report the MAXIMUM, AVERAGE, and MINIMUM quantities of the listed materials that you maintain at your site at any time. Indicate how you arrive at this number. (M-measured, E-Estimate). Also check the operations in which you use these materials. Please add continuation sheet if required.

Please place "x" in appropriate column

Chemical Name	CAS No.	Maximum	Average	Minimum	Operations					
					Product	Waste	Stored	Manufactured or generated	Shipped	

Materials Inventory (continued)

In addition to the specified chemicals, are there any substances at your location that could be immediately dangerous to the life and health of the general public if present in the atmosphere at levels of 2,000 ppm or less? If so, please list the substances and the quantities you have on site, indicating how you arrive at this number. Also, check the operations in which you use these materials. Please add continuation sheet if required.

Chemical Name	CAS No.	Maximum	Average	Minimum	Operations Please place "x" in appropriate column					
					Product	Waste	Stored	Manufactured or generated	Shipped	

2. Safety Features

As attachment 1 to this survey, please describe the safety precautions you observe when handling hazardous materials of the type identified under "materials inventory." Please comment specifically if these substances are under refrigeration or pressure and how you prevent uncontrolled releases. For example, precautions against tank ruptures, utility failures, earthquakes, etc.

3. Security Features

As attachment 2, please describe security precautions at your site. How do you guard against vandalism, sabotage, and unauthorized entry? Do you have fences, guards, alarms, etc.?

4. Audits

As attachment 3, please indicate if you conduct any self audit of your facility? If so, at what frequency? When was the last audit? If possible, include a synopsis or a copy of the latest audit.

5. Incident History

As attachment 4, please provide a chronology of all safety related incidents that have occurred in the past 3 years that are reportable under Federal and State regulations.

6. Permits

As attachment 5, please list the permits you have received from Federal, State, and local agencies for the handling of the above listed hazardous materials.

7. Outside Inspections

As attachment 6, please list by agency and date, any hazardous materials related inspection of your site during the past 3 years.

Training

8. As Attachment 7, please describe the in-house training conducted for workers and staff related to equipment safety, noting how frequently this training is administered.

PART C: CONTAINMENT/EVACUATION INFORMATION

- Emergency communication, alarms, and equipment: (Please use continuation sheets as required)

	Location	Description of Equipment
. Internal Communication and Alarms		
. External Communications and Alarms		
. Fire Fighting Equipment		
. Spill Control Equipment		
. Decontamination Equipment		

2. **Arrangements with Local Authorities**

(please place "x" in appropriate column)

A. Please indicate below the local authorities (if any) with whom agreements exist relative to alert and evacuation in the event of a disaster. As attachment A, please provide a copy or synopsis of these agreements.

Local Authorities (please identify by organization and phone number)	Familiar with facility layout	Familiar with properties of hazardous materials handled at the facility and associated hazards	Familiar with places where facility personnel would normally be working	Familiar with entrances to and roads inside the facility	Familiar with possible evacuation routes
Police:					
Primary: ____________					
Alternate: ____________					
Fire Department:					
Primary: ____________					
Alternate: ____________					
Local Emergency Response Team:					
Primary: ____________					
Alternate: ____________					
State Emergency Response Team:					
Primary: ____________					
Alternate: ____________					
Emergency Response Contractors:					
Primary: ____________					
Alternate: ____________					

B. Please list any hospitals or medical clinics and doctors that have specialized knowledge concerning the properties of hazardous materials handled at your facility.

Hospitals: (please identify by name)

Primary: ______________________________

Alternate: ______________________________

None: ☐

Doctors:

Primary: ______________________________

Alternate: ______________________________

None: ☐

C. **Emergency Procedures**:

Please describe your emergency procedures for each of the following in the event an incident should require some measure of civil alert or evacuation. (Either enclose a plan, or a summary of same, as attachment 9.)

A. **Fire**:

____

____

____

____

____

____

B. **Explosions**:

____

____

____

____

____

____

C. Emergency Procedures: (continued)

C. Releases of Hazardous Materials:

D. Evacuation:

Appendix D

COMPANIES AUDITED (ON-SITE)

Allied Corporation

Amvac Chemical Corporation

B. F. Goodrich

Cargill Chemical Products

Chevron

Dow Chemical USA

GATX

Golden West Refining

Jones Chemicals, Inc.

Keysor-Century Corporation

Monsanto

Neville

Niklor Chemical Company

Paramount Petroleum Corporation

Procter and Gamble

Stepan

Texaco

Upjohn

Witco

Appendix E

South Coast
AIR QUALITY MANAGEMENT DISTRICT
9150 FLAIR DRIVE, EL MONTE, CA 91731 (818) 572-6200

AUDIT CHECKLIST

I. SUPPORT OPERATIONS

A. Safety Organization

1. To what level of management does the organization report?
2. What are the qualifications of the person responsible for safety?
3. What is the size and capabilities of the safety organization?
4. What are its functions?
5. Is there a formalized safety program?
6. How is it structured?
7. Are there regular employee meetings in which safety is the primary topic?

B. Training

1. What type of training is administered to operators of equipment used in conjunction with hazardous materials?
2. Are there refresher courses, tests, or certifications required?

C. Maintenance

1. Is there a program of regular preventative maintenance?
2. How is safety equipment tested and maintained?

D. Checks/Audits

1. Are self-audits conducted on a scheduled basis?
2. Have any technical audits by outside parties been commissioned within the last three years?

E. Emergency Plans

1. How is the emergency response system organized for reaction to non-work hour emergencies, such as:

   a. Earthquake

   b. Flood

   c. Fire

   d. Sabotage/terrorist

   e. Hazardous materials release

II. RECORDS

A. How are plant records maintained relating to incidents/injuries/releases related to the handling, storage, use and disposal of hazardous material? Have there been any significant incidents?

B. When and how are these incidents reported and to whom? What are the required actions?

C. Determine from plant records the maximum amount of hazardous materials stored on the site for the past three years. How do these values compare to those reported in the questionnaire?

D. Plant Construction

1. When was the plant built? By whom?

2. What are the design and construction criteria?

3. Have there been any additions or modifications?

4. When and what were these changes?

III. PROCESS OPERATIONS

A. Transfer of Hazardous Material into the Plant

1. How does material arrive at the plant?

2. Is there a check to determine if it is the correct material before unloading?

3. How is it unloaded?

4. Is there a standby crew during unloading?

5. What safety precautions?

6. Is a supervisor present?

7. Under what circumstances will material not be unloaded?

B. Use of Hazardous Materials

1. How is hazardous material used in process?

2. How are process variables controlled to prevent overheating or overpressuring of hazardous material?

3. How are plant operators notified of process upset?

4. Do you have redundancy of safety and warning systems?

5. Is there a safety margin in the plant design?

6. In the event of a leak, are there any control systems that will capture or neutralize released materials?

C. Storage of Hazardous Material

1. What are the sizes of the storage vessels?

2. What are their safety features? If refrigeration, heating, cooling or other special precaution is needed, are there backup systems?

3. Are temperature, pressure, quantity monitored? Connected to alarms?

4. Can leaks or contamination be quickly ascertained?

5. How is monitoring evaluated?

D. How are waste hazardous materials disposed of?

IV. LOCATION AND SETTING

A. Population

1. What is population within one mile radius? Within five mile radius?

2. Distance to freeways?

3. Distance to schools, hospitals, etc?

B. Meteorology

1. What are the prevailing wind directions?

Appendix F

South Coast
AIR QUALITY MANAGEMENT DISTRICT
9150 FLAIR DRIVE, EL MONTE, CA 91731 (213) 572-6200

SAMPLE LETTER TO COUNTIES

February 11, 1985

The disaster in Bhopal, India, focused world attention on the potential for calamity from the accidental release of toxic air emissions. In the wake of the Bhopal tragedy, a national priority has been accorded--both by government and industry--to a review of the potential for similar accidents in the United States.

Based upon a cursory examination of our local situation, the South Coast Air Quality Management District has concluded that:

- A Bhopal-type incident, though less likely here, cannot be ruled out as a possibility.
- Current contingency plans are oriented primarily toward the localized emergency and may not be adequate to cope with a disaster requiring mass civil notification and evacuation.

Accordingly, the District's Governing Board, with support from state and local authorities, has directed that a study be undertaken addressing both the state of accident prevention and the state of emergency response within the South Coast Air Basin. The study's focus is primarily on the major catastrophe-type incident and will consist of two concurrent phases.

1. A prevention and response assessment of industrial stationary sources within the District, to include data gathering and select on-site surveys.
2. An assessment of state and local contingency plans relating to community preparedness in the event of such a catastrophe.

This letter is intended to inform you of our study, to solicit your assistance and support, and to stress the importance of a timely response to our request for data. Specifically, I am requesting that the attached questionnaire be returned to my office by March 4, 1985.

We are working closely with the appropriate state agencies in coordinating this study. However, the local jurisdictions, at the county and city levels, are the key sources from which data is needed. These also are the sources with whom we will work closely in developing realistic recommendations. Due to time constraints, it is impractical to gather data for all the cities that come under the purview of the South Coast Air Basin. However, in your reply, we ask that you include at least those cities within the county which, in your judgment, could require emergency evacuation of a large fraction of the population due to the accidental emission into the atmosphere of a hazardous substance from a stationary site.

Whereas no single effort is ever a panacea for getting everything done, we believe this study may help alleviate certain community concerns and also place in sharper focus the additional resources that may be needed to ensure adequate preparedness should a major disaster occur.

If you have any questions regarding the project or questionnaire, please contact Mr. Gene Calafato (818) 572-6451 or, in his absence, me at (818) 572-6400.

Thank you for your cooperation.

Very truly yours,

JA Stuart

J. A. Stuart
Executive Officer

JAS:drw

Attachment

Appendix G

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

CIVIL PREPAREDNESS QUESTIONNAIRE

Name of County: ______________________________

Civil Preparedness Contact

Name: ____

Address: ____

Phone: (   ) ____________

I. ORDINANCE ("Right to Know" by a community as to which chemicals are manufactured, stored, trans-shipped in that community)

A. Please indicate which cities in your county have a "right to know" ordinance and the date it became effective. Please provide a copy of each ordinance if readily available.

City	Effective Date

B. Please indicate which cities in your county are now actively considering the adoption of a "right to know" ordinance as described above.

____

____

____

____

II. HAZARDOUS SUBSTANCE INVENTORY

A. At either the county or city level, does there currently exist any comprehensive and currently maintained inventory of hazardous substances manufactured and/or stored in the county or in a city. (This includes those inventories maintained by the respective fire departments.) Yes ____ No ____

B. If the answer above is "yes", please provide the following information for each inventory:

Location (City) of Inventory	Contact Point	Frequency of Update
____________________	________________	_______
____________________	________________	_______
____________________	________________	_______
____________________	________________	_______
____________________	________________	_______
____________________	________________	_______
____________________	________________	_______
____________________	________________	_______

C. If the answer to "A" above is "no", for which cities (if any) would the County consider such an inventory either "essential" or "useful".

(Please check appropriate blank)

City	Essential	Useful
_________________________	____	____
_________________________	____	____
_________________________	____	____
_________________________	____	____
_________________________	____	____

III. NOTIFICATION AND EVACUATION

A. Over the past three years, has there been any toxic release in the county that required the mass temporary evacuation of 300 or more people? Yes ____ No ____

B. If the answer to "A" is "yes", for each incident please specify:

Date	Location City & Plant	Toxic Substance Released	No. of People Evacuated	Injured

C. Do any county or city plans currently require the exercise of alert or evacuation procedures at specified intervals? Yes ____ No ____

D. If the answer to "C" is "yes", please identify the plan(s) and indicate the date(s) that the alert and/or evacuation procedure has been exercised during the past three years. (The above is exclusive of hospital emergency exercises.)

Plan	Date(s) (indicate whether alert or evacuation)

E. Please specify by city the type of alert/warning system currently in effect to notify residents of the need to evacuate. Also, please provide a copy of any plan/procedure relating to the implementation of this system. (Please use continuation sheet if required.)

City	System Description: Manufacturer-Model Designation

F. Do you consider these systems adequate in all essential aspects, i.e., response time, range, etc.? Yes ____ No ____

G. If the answer to "F" is "no", what would be required to make it satisfactory (to include cost)?

____

____

____

IV. TRAINING

A. Please indicate for each Hazardous Material Team in your county the following information: (Please use continuation sheet if required.)

Location	No. of Personnel	Degree of Readiness	
		Fully Qualified	Partially Qualified

B. Do you consider the current number of teams adequate to meet the requirements of your county? Yes ____ No ____

C. If the answer to "B" is "no", please provide the following information for each additional team required:

Location (City)	No. of Personnel	Estimated Cost

D. What is the average elapsed time between incident notification and on scene arrival for the Hazardous Material team? ____________

E. Is the level of training for fire department personnel in each city adequate to cope with accidental toxic air emissions? Yes ____ No ____

F. If the answer to "E" is "no", please specify by city the type of additional training required and the approximate cost. (Please use continuation sheet if required.)

City	Training	Estimated Cost

G. Please provide a copy of all county-issued plans/procedures relating to community emergency evacuation.

V. OVERALL ASSESSMENT

A. Given today's resources, are the cities you have selected capable of satisfactorily carrying out the mass evacuation of 1000 or more residents in the event of a primary disaster, i.e., one which strikes suddenly and causes widespread death and injury? Yes ____ No ____

B. If the answer to "A" is "no", please prioritize below the resources that are required to achieve a satisfactory readiness standard. In each case, please itemize approximate cost and relate this information to a specific city.

City	Resources Required	Estimated Cost

Appendix H

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

HAZARDOUS MATERIALS INVENTORY

CHEMICAL NAME

Acrolein
Acrylonitrile
Allyl alcohol
Allyl chloride
Ammonia
Arsine
Benzene
beta-Propiolactone
bis-Chloromethyl ether
Boron trifluoride
Bromine
Bromoacetone
1,3-Butadiene
n-Butyl amine
Carbon disulfide
Carbon monoxide
Carbon tetrachloride
Chlorine
Chlorine dioxide
Chlorine trifluoride
Chloroacetaldehyde
Chloroform
Chloropicrin
Chloroprene
Crotonaldehyde
Cyanogen
Cyanogen chloride
Diazomethane
Diborane
Diethylamine
Diisopropylamine
Dimethylamine
1,1-Dimethylhydrazine
Dioxane
Diphosgene
Epichlorohydrin
Ethylacrylate
Ethylene chlorohydrin
Ethylene dibromide
Ethylene dichloride
Ethylene Dichloroarsine
Ethylene imine
Ethylene oxide
Ethylene
Fluorine
Formic acid
Hydrazine
Hydrogen bromide
Hydrogen chloride
Hydrogen cyanide
Hydrogen flouride
Hydrogen selenide
Hydrogen sulfide
Ketene
Methyl acrylate
Methyl bromide
Methyl chloroform
Methyl chloromethyl ether
Methyl dichloroarsine
Methyl iodide
Methyl isocyanate
Methyl ethyl mercaptan
Methylamine
Monomethyl hydrazine
Nickel carbonyl
Nitric Acid
Nitric oxide
Nitrogen dioxide
Nitrogen tetroxide
Nitrogen trifluoride
Nitromethane
n-Nitrosodimethyl amine

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

HAZARDOUS MATERIALS INVENTORY

CHEMICAL NAME

Oleum

Osmium tetroxide

Oxygen difluoride

Ozone

PCB's

Pentaborane

Perchloromethyl mercaptan

Perchloryl fluoride

Phosgene

Phosphine

Toluene diisocyanate

Perchloroethylene

Pentachlorophenol

Phosphorus pentachloride

Phosphorus trichloride

Propylene dichloride

Propylene imine

Propylene oxide

Selenium hexafluoride

Stibine

Styrene

Sulfur dioxide

Sulfur pentafluoride

Sulfuryl fluoride

Tellurium hexafluoride

Tetramethyl lead

Tetramethyl succinonitrile

Titanium tetrachloride

Toluene

1,1,1-Trichloroethane

Trichloroethylene

Triethylamine

Trimethylamine

Vinyl chloride

Appendix I

SAMPLE LETTER TO CITIES

March 8, 1985

In December 1984, shortly after the disaster in Bhopal, India, the South Coast Air Quality Management District conducted a cursory review of our preparedness in the South Coast Air Basin area and concluded that:

- A Bhopal-type incident, though less likely here, cannot be ruled out as a possibility.
- Current contingency plans are oriented primarily toward the localized emergency and may not be adequate to cope with a disaster requiring mass civil notification and evacuation.

Accordingly, the District's Governing Board, with the support from state and local authorities, directed that a study be undertaken addressing both the state of accident prevention and the state of emergency response within the South Coast Air Basin. The study's focus is on the major catastrophe-type incident and consists of two concurrent phases:

1. A prevention and response assessment of industrial stationary sources, to include data gathering and select on-site surveys.
2. An assessment of state and local contingency plans relating to community preparedness in the event of such a catastrophe.

In the course of the December review, numerous contacts were made with local fire department and law enforcement personnel. From these meetings it became clear that additional resources are needed at the city level, and better integration of support activities is required at all levels, in order to cope with a major disaster that could impact a thousand or more people. Hence, a prime focus of the current study is directed toward identifying specifics in this regard and developing a supportable basis to justify the additional expenditures that will be required.

Approximately one month ago a questionnaire was sent to each county office responsible for disaster preparedness requesting assistance in obtaining data and formulating recommendations. Our initial approach was to work through the County Disaster Preparedness offices in view of their broad responsibilities in this area and an expressed interest by some in being the principal coordinator for this effort. So far the general response has been excellent and in three of the counties the data gathering is proceeding well. However, Los Angeles County because of its size and the high concentration of industry poses some complexity. In a letter received from A. A. Hearne, Environmental Management Deputy, Department of Health Services, it is suggested that we work directly with the cities in determining individual problems and needs associated with emergency response. (I am including for your information a copy of Mr. Hearne's letter and of the data provided by the County.)

Our most immediate need is for the information requested in the attached questionnaire. This can best be provided by those who ultimately have the operational responsibility for getting the job done. We have found that these also are the individuals who cooperate most readily, recognizing fully the implications of being unable to respond satisfactorily in the case of such an emergency.

Due to the time constraints imposed by the Governing Board, I would appreciate having the questionnaire completed and returned by April 5, 1985. Also, it would be helpful if we are given a focal point for contact and coordination in your city. In certain cases, I can foresee the desirability of a follow-on meeting between city officials responsible for emergency preparedness and our Study Director, Mr. Gene Calafato.

As we noted to the county officials, no single effort of this type is necessarily a panacea for getting everything done. However, in view of the community and government attention that is being given to the Bhopal disaster, the timing seems right for us to jointly make a case for the resources you require to ensure adequate response should a major disaster occur. Toward this end, your cooperation is very much needed.

If you have any questions regarding the study or questionnaire, both Gene Calafato (818) 572-6451 and I (818) 572-6400 are available to you.

Sincerely,

JA Stuart

J. A. Stuart
Executive Officer

JAS:pmj

Enclosures

Appendix J

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

CIVIL PREPAREDNESS QUESTIONNAIRE

Name of City: ______________________

Civil Preparedness Contact

Name: ______________________

Address: ______________________

Phone: ( ) __________

I. ORDINANCE

A. Please indicate if your city has a "right to know"* ordinance and the date it became effective. Please provide a copy of this ordinance if readily available.

____

__________ __________

B. If your city does not have such an ordinance, please indicate if it is now actively considering its adoption.

____

____

II. HAZARDOUS SUBSTANCE INVENTORY

A. Does there currently exist any comprehensive inventory of hazardous substances manufactured and/or stored in your city.

Yes ____ No ____

B. If the answer above is "yes", please provide the following information for each inventory:

Location	Contact Point	Frequency of Update

*("Right to Know" by a community as to which chemicals are manufactured, stored, trans-shipped in that community)

C. If the answer to "A" above is "no", please indicate if you consider such an inventory "essential", "useful" or "unnecessary".

(Please check appropriate blank)

Essential	Useful	Unnecessary
____	____	____

D. If the answer to "C" above is "essential" or "useful", please indicate by whom the inventory should be kept and how it would be used.

____

____

____

III. NOTIFICATION AND EVACUATION

A. Over the past three years, has there been any toxic release in your city that required the mass temporary evacuation of 300 or more people? Yes ____ No ____

B. If the answer to "A" is "yes", for each incident please specify:

Date	Location	Toxic Substance Released	No. of People Evacuated	Injured
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____

C. Do any county or city plans currently require the exercise of evacuation procedures at specified intervals? Yes ____ No ____

D. If the answer to "C" is "yes", please identify the plan(s) and indicate the date(s) that the evacuation procedure has been exercised during the past three years. (The above is exclusive of hospital emergency exercises.)

Plan	Date(s) of Exercise

E. Please specify the type of alert/warning system currently in effect in your city to notify residents of the need to evacuate and estimate the anticipated response time. Also, please provide a copy of any plan/procedure relating to the implementation of this system. (Please use continuation sheet if required.)

Systems Description: Manufacturer-Model Designation

IV. TRAINING

A. Please indicate for each Hazardous Material Team in your city the following information: (Please use continuation sheet if required.)

	No. of	Degree of Readiness	
Location	Personnel	Fully Qualified	Partially Qualified

B. Do you consider the current number of teams adequate to meet your requirements? Yes ____ No ____

C. If the answer to "B" is "no", please provide the following information for each additional team required:

No. of Personnel	Estimated Cost

D. What is the average elapsed time between incident notification and on scene arrival for the Hazardous Materials team? ____________

E. Is the level of training for fire department personnel adequate to cope with accidental toxic air emissions? Yes ____ No ____

F. If the answer to "E" is "no", please specify the type of additional training required and the approximate cost. (Please use continuation sheet if required.)

Training	Estimated Cost

G. Please provide a copy of all city-issued plans/procedures relating to community emergency evacuation.

V. OVERALL ASSESSMENT

A. Given today's resources, is your city capable of satisfactorily carrying out the mass evacuation of 1000 or more residents in the event of a primary disaster, i.e., one which strikes suddenly and causes widespread death and injury? Yes ____ No ____

B. If the answer to "A" is "no", please prioritize below the resources that are required to achieve a satisfactory readiness standard. In each case, please itemize approximate cost.

Resources Required	Estimated Cost

EXHIBIT B

EXAMPLE OF TYPICAL EXISTING SCAQMD AIR RULE

EXHIBIT B

EXAMPLE OF TYPICAL EXISTING
SCAQMD AIR RULE

(Adopted June 7, 1985)(Formerly Rule 1005.1)

RULE 1163. CONTROL OF VINYL CHLORIDE EMISSIONS

(a) Applicability
- (1) This rule applies to plants which produce:
  - (A) Ethylene dichloride by reaction of oxygen and hydrogen chloride with ethylene,
  - (B) Vinyl chloride by any process, and/or
  - (C) One or more polymers containing any fraction of polymerized vinyl chloride.
- (2) The provisions of this rule apply in addition to the provisions of Regulation X, Subpart F.

(b) Definitions

For the purpose of this rule, the following definitions shall apply:
- (1) All definitions stated in Regulation X, Subpart F.
- (2) Leak means the detection of vinyl chloride from any location other than a stack vent or designed equipment opening from which vinyl chloride exceeds the background concentration by ten ppm. Such determination shall be made five centimeters from the potential source, using an analyzer employing flame ionization or photodetection methods, which may be portable, and having a sensitivity of at least 1 ppm, or by employing any device or analyzer which the Executive Officer determines is equivalent.
- (3) Background level means the concentration of vinyl chloride in the atmosphere within the plant premises, which is not predominently influenced by an specific emission point, and which is determined at least three meters upwind of any potential source being inspected.
- (4) Designated Plant means an ethylene dichloride, vinyl chloride or polyvinyl chloride plant.
- (5) Continuous Stack Monitoring means sampling is done on a continuous basis, with actual samples being taken at least every fifteen minutes.
- (6) Modification means a physical change in, or a change in the method of operation of, a designated plant. For the purposes of this definition:
  - (A) Routine maintenance or repair shall not be considered to be physical changes, and
  - (B) A change in production rate or operating hours shall not be considered to be a change in the method of operation, provided that these increases are not contrary to any existing permit to operate conditions.
- (7) Receiving Vessel is a sealed container used to receive gaseous discharge from vent valves and other equipment. For the purpose of this rule, a monomer recovery vessel shall be considered as a receiving vessel.

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(c) Control Requirements

After the effective date of this rule, a person operating a designated plant shall vent the following equiment containing more than ten ppm of vinyl chloride to air pollution control equipment or other processes which comply with the requirements of subparagraph (e) of this rule:

(1) Vents of or appurtenances venting:

- (A) Reactors.
- (B) Storage tanks or surge tanks.
- (C) Purification vessels or other equipment used for purification.
- (D) Stripper vessels.
- (E) Combination reactor-stripper vessels.
- (F) Mixing, weighing or holding tanks.
- (G) Monomer recovery equipment.
- (H) Receiving vessel.
- (I) Other equipment as required by the Executive Officer.

(2) Exemption

The provisions of paragraph (c)(1) shall not apply to equipment which has been purged by liquid displacement and the purged gas vented to air pollution control equipment.

(d) Ambient Air Concentration Requirements

A person operating a designated plant shall not allow the discharge into the atmosphere of any materials which result in ambient concentrations of vinyl chloride which are equal to or greater than ten parts per billion of vinyl chloride, 24-hour average measured at any point beyond the property line of such plant at which persons reside or work. Such measurements shall be performed using methods specified by the California Air Resources Board or any other method approved by the Executive Officer in establishing the Vinyl Chloride Ambient Air Quality Standard. A copy of such methods may be obtained from the District Executive Officer upon request.

(e) Air Pollution Control Equipment

(1) The owner or operator of the air pollution control equipment specified in this rule shall at all times operate such equipment at an efficiency sufficient to limit the total amount of vinyl chloride in the discharge of all such control equipment to less than 50 grams per hour for polyvinyl chloride plants and less than 50 grams per hour for both ethylene dichloride and vinyl chloride plants. Such 50 grams per hour limit shall apply to the discharge of control equipment serving all polyvinyl chloride plants on a premise. A separate 50 gram per hour limit shall apply to the discharge of control equipment serving any combination of ethylene dichloride and vinyl chloride plants on a premise.

(2) A continuous stack monitoring system, or equivalent, measuring the flow rate, concentration, and showing the mass flow rate of vinyl chloride discharged from the control equipment shall be installed. Such system shall be approved by the Executive Officer prior to installation. Violations of the standard specified in subparagraph (e)(1), as measured by such systems, shall be reported to the Executive Officer within two hours of such measurements. The records

from such monitoring equipment shall be maintained for two years and shall be summarized monthly in the form and manner specified by the Executive Officer. Whenever the stack monitoring system is not in proper operation or out of service, alternate methods shall be used to monitor the vinyl chloride concentrations on an hourly schedule. The Executive Officer may waive the requirements of this subsection for those operations for which he deems them unnecessary, and shall notify the District Board of the granting of such waivers in writing.

(3) Other methods may be employed which reduce vinyl chloride emissions to the same degree of subparagraphs (c) and (e)(1) provided that:

(A) A control plan is submitted which details the measures which the owner or operator intends to implement, and such plan is approved by the Executive Officer, based on his findings that such measures are equivalent to the measures required by subparagraph (e)(1).

(B) Applications are submitted for new permits to construct or operate both the basic and control equipment involved regardless of whether modifications or additions are to be made either to the basic or control equipment, or both. Existing permits to operate pertaining to the basic and control equipment as specified above shall be surrendered and canceled at the time such new permits to construct or operate are issued. Such new permits shall not be effective unless surrender of such existing permits has been made. If such new permits are denied, such existing permits surrendered pursuant to this section shall be re-issued and restored subject to the same conditions which were applicable to the original permits prior to surrender and the provisions of subparagraph (e)(1) shall be applicable.

The Executive Officer shall impose those written conditions on such new permits specifying emission limits or other conditions which may be necessary to insure that the emission limitations under this rule are met.

(f) Operational Requirements

(1) All vent valves are relief devices (except emergency relief valves) on equipment upstream of the stripping operation or post catalysis shall be vented to a receiving vessel.

(2) Product from reactors which cannot be used in subsequent operations, such as stripping, blending or drying, shall be discharged to a sealed container, which shall be vented to a receiving vessel; or stripped to a degree acceptable to the Executive Officer before discharge.

(3) Failure of the rupture disc preceding an emergency relief valve which results in a discharge to the atmosphere of vinyl chloride monomer from equipment upstream of a stripping operation shall be deemed a violation of this rule, unless the gaseous discharge is vented to a receiving vessel or air pollution control equipment.

An equivalent system which has been approved by the Executive Officer may be substituted for the requirement for venting the discharge of the emergency relief valve. Any discharge to the atmosphere of vinyl chloride from such an equivalent system shall be deemed a violation of this rule.

(4) Rectors and other equipment upstream from the stripper shall be equipped with automatic pressure reduction systems which will open at a pressure between operating pressure and the emergency pressure relief valve setting. The vapors from such pressure reduction systems shall be directed to a receiving vessel, vapor recovery system, or air pollution control system. The provisions of this subsection shall not apply to ethylene dichloride plants.

(g) Management Plan

The owner/operator of a designated plant shall submit to the Executive Officer for his approval, a Management Plan for the reduction of vinyl chloride emissions.

The Management Plan for the reduction of vinyl chloride emissions must include, but is not limited to:

(1) A plan and schedule to locate and identify all sources of vinyl chloride emissions which might contribute to exceedences of the ambient concentration requirements of subsection (d).

(2) An outline of a training program to routinely instruct employees, including supervisors, on methods to prevent vinyl chloride emissions.

(3) A method of screening operating records or other data to detect equipment operators who may periodically cause excessive vinyl chloride emissions because of misoperation of equipment.

(4) An outline of a special training program or other measures to eliminate the emissions, cited in subsection (g)(1).

After approval of the Management Plan, all applicable operations shall be conducted according to said Plan.

(h) Leaks

(1) Except as provided in subparagraph (h)(5), a person shall not use any compressor, flange, pump, valve, storage container, process vessels, or other equipment containing or using vinyl chloride in a designated plant unless such equipment is free of vinyl chloride leaks.

(2) Except as provided in subparagraph (h)(5), a person shall not use any rail tank cars, tank trucks or shipping containers used to transport vinyl chloride unless such equiment is free of vinyl chloride leaks.

(3) All flanges, pumps, valves, storage containers and process vessels shall be inspected for leaks within 90 days after the effective date of this subparagraph. Thereafter, all compressors, pumps and valves shall be inspected each three months following such initial inspections. All flanges, reactors and process equipment shall be inspected each six months following such initial inspections. All inspections shall be the responsibility of the plant operator, and

shall include checks for possible leakage as defined in subparagraph (b)(2).

(4) All detected leaks by the operator shall be recorded in an inspection record along with the date and inspector's initials. Such records shall be maintained for two years.

(5) Any detected leaks by the operator shall be eliminated within 24 hours of detection.

(6) Ninety days after the effective date of this subparagraph, except as provided in subsection (h)(5), any leaks detected by the District shall be deemed a violation of this rule and shall be repaired and eliminated within 24 hours of detection.

(i) Ambient Air Montoring

A person operating a designated plant shall comply wth the following requirements for ambient air monitoring facilities.

(1) Provide and operate up to four air monitoring stations to continuously measure and record ambient concentrations of vinyl chloride in the vicinity of such plants. The exact number and location of such monitoring stations shall be approved by the Executive Officer; and

(2) Provide and operate up to four additional air monitoring stations to continuously measure and record ambient concentrations of vinyl chloride in populated areas near such plants. The exact number and location of such monitoring stations shall be approved by the Executive Officer.

(3) Calibrate and maintain the required ambient air monitoring stations in accordance with procedures specified in subparagraph (d);

(4) Keep the records from the required air monitoring stations for a period of two years. The data from such records shall be summarized monthly and shall be submitted in the manner and form specified by the Executive Officer.

(5) Breakdowns of the vinyl chloride ambient air monitoring equipment shall be reported to the Executive Officer within 12 hours after the time such breakdowns are first found. Non-operation or faulty operation of such equipment for longer than 96 hours shall be deemed a violation of this rule.

(6) Measure meterorological data consisting of wind direction and wind speed. Such data shall be summarized and submittted in the form and manner specified by the Executive Officer. The original records shall be retained for a period of two years.

(7) A person operating a designated plant which produces ten million pounds or less of vinyl chloride polymer, in any year, is exempt from the provision of subsection (i)(2).

(j) New or Modified Plants

After May 1, 1980, a person shall not build a new designated plant or modify an existing designated plant unless that person demonstrates to the Executive Officer that the ambient air quality will not exceed the California Vinyl Chloride Ambient Air Standards as a result of any emissions from a new plant or any increase in emissions from a modified plant.

(k) Exemptions

(1) A designated plant is exempt from the provisions of this rule, except subparagraphs (g), and (h) if the plant operator can show to the satisfaction of the Executive Officer that the plant has not exceeded the provisions of subparagraph (d) for a period of six months continuously, and maintain at least one air monitoring station as required by subsection (i)(1). A designated plant which produces ten million pounds or less of vinyl chloride polymer, an any one year, is exempt from the air monitoring station requirements of this subsection.
Such exemption will be granted in writing by the Executive Officer. After obtaining a written exemption from the Executive Officer, if a designated plant violates the provisons of subparagraph (d), such written exemption from the Executive Officer shall be void, unless it is shown that such violations are caused by minor, non-periodic and infrequent breakdowns, as determined by the Executive Officer.

(2) This rule does not apply to equipment used in research and development if the reactor used to polymerize the vinyl chloride processed in the equipment has a capacity of no more than 0.19 m (50 gallons).

(l) The provisions of this rule shall be effective according to the compliance schedule stated below:

(1)

Subparagraph	Effective Date
(g) Management Plan	90 days from the adoption of this rule.
(h) Leaks	60 days from the adoption of this rule.
(c) Control Requirements	One year from the adoption of this rule.
(d) Ambient Air Concentration Requirements	One year from the adoption of this rule.
(e) Air Pollution Control Equipment	One year from the adoption of this rule.
(f)(1), (f)(2), (f)(3)	One year from the adoption of this rule.
(i) Ambient Air Monitoring	One year from the adoption of this rule.

(2) Within one year from the date of adoption of this rule, a person operating a designated plant shall install and thereafter operate pressure indicating and recording instruments (or equivalent as

approved by the Executive Officer) monitoring the discharge of emergency relief valves and manual vent valves located on equipment upstream of the stripping operation. The data from such instruments shall be summarized monthly and shall be submitted to the Executive Officer in the form and manner specified. The records from such instruments shall be maintained for two years.

(3) The provisions of subparagraph (f)(4) shall not be applicable unless all of the following occurs:

(A) Twelve months have passed since the date of adoption of this rule and thereafter, two violations per month of the ambient air concentration requirement of subparagraph (d) have occurred in two consecutive months; and

(B) The Executive Officer has determined that such violations of the concentration requirement were caused by venting of vinyl chloride from emergency relief valves, or manual vent valves, located on equipment upstream of the stripping operation; and

(C) The Executive Officer gives written notice of such determination, along with a specification of the basis for his determination, and a description of the equipment to be subject to the requirements of subparagraph (f)(4) to the owner or operator of the source(s) determined to be responsible for such violations.

(4) All provisions of subparagraph (f)(4) applicable to the equipment specified by the Executive Officer in his notice of determination shall be complied with no later than one year from the date of the Notice of Determination.

(m) Severability

If any portion of this rule shall be found to be unenforceable, such finding shall have no effect on the enforceability of the remaining portions of the rule, which shall continue to be in full force and effect.

EXHIBIT C

SUMMARY OF INVENTORY SURVEY OF DESIGNATED CHEMICALS IN SCAQMD

EXHIBIT C

SUMMARY OF INVENTORY SURVEY OF DESIGNATED CHEMICALS IN SCAQMD

	Chlorine				Hydrogen Fluoride			
Company	Maximum	Average	Minimum	Units	Maximum	Average	Minimum	Units
--- Refineries:								
Refinery 1	20000	10000	6000	lbs				
Refinery 2		32		2000# cylinders				
Refinery 3	40000	16000	4000	lbs	650000	450000	0	gal
Refinery 4	48	23	18	2000# cylinders				
Refinery 5	2000	1000	0	lbs				
Refinery 6	2	1	0	2000# cylinders				
Refinery 7	4000	2000	500	lbs				
Refinery 8	24000	8000	4000	lbs				
Refinery 9	8	5	4	2000# cylinders		41951		gal
Refinery 10	24	17	10	2000# cylinders				
Refinery 11	5	2	1	2000# cylinders		5000		gal
Refinery 12	3	1.5	1	2000# cylinders				
Refinery 13		20000		lbs		438		MSCFH
--- Chemical Plants:								
Chemical Plant 1	1	1	1	ton				
Chemical Plant 2	6	4	2	150# cylinders				
Chemical Plant 3	600	300	100	lbs				
Chemical Plant 4	90	45	0	tons				
Chemical Plant 5		5		??????				
Chemical Plant 6		2		tons				
Chemical Plant 7		1		2000# cylinders				
Chemical Plant 8	540000	270000	90000	lbs				
Chemical Plant 9								
Chemical Plant 10	2	1	1	2000# cylinders				
Chemical Plant 11	6	3	3	tons				
Chemical Plant 12								
Chemical Plant 13								
Chemical Plant 14								
Chemical Plant 15								
Chemical Plant 16								
Chemical Plant 17								
Chemical Plant 18								
Chemical Plant 19								
Chemical Plant 20								
Chemical Plant 21								
Chemical Plant 22								
Chemical Plant 23								
Chemical Plant 24								
Chemical Plant 25								
Chemical Plant 26								
Chemical Plant 27								
Chemical Plant 28								
Chemical Plant 29								
Chemical Plant 30								
Chemical Plant 31								
Chemical Plant 32								
Chemical Plant 33								
Chemical Plant 34								
Chemical Plant 35								
Chemical Plant 36								
Chemical Plant 37								

Company	Chlorine				Hydrogen Fluoride			
	Maximum	Average	Minimum	Units	Maximum	Average	Minimum	Units
--- Chemical Packaging:								
Chem. Packaging 1	5	2	<1	tons				
Chem. Packaging 2	?????	?????	?????					
Chem. Packaging 3	200	100	0	2x1 gal cs.				
	50	25	5	150# cylinders (gas)				
Chem. Packaging 4	2000000	1000000	800000	lbs	514000	300000	180000	lbs
Chem. Packaging 5	5	3	1	tank cars				
Chem. Packaging 6	180	90	0	tons				
Chem. Packaging 7					250	100	50	gal (70%
--- Water Treatment:								
Water Treatment 1	25	20	12	2000# cylinders				
Water Treatment 2	540	270	90	tons (railcar)				
	4	2	1	2000# cylinders				
Water Treatment 3	10	8	2	tons				
--- Misc.:								
Misc. 1	"Cylinder Quantities Only"				"Cylinder Quantities Only"			
Misc. 2					1	0.5	0	gal
Misc. 3					???? quantity unspecified			
Misc. 4					5500	4500	3500	gal
Misc. 5								
Misc. 6								
Misc. 7								
Misc. 8								
Misc. 9								
Misc. 10								
Misc. 11								
--- Chemical Shipping:								
Chem. Shipping 1								

	Anhydrous Ammonia				Aqueous Ammonia			
Company	Maximum	Average	Minimum	Units	Maximum	Average	Minimum	Units
--- Refineries:								
Refinery 1	15	10	5	tons				
Refinery 2						22000		gal
Refinery 3					12000	6000	0	gal
Refinery 4	5	3	2	150# cyl.				
Refinery 5					500	250	100	gal
Refinery 6					1500	700	200	gal
Refinery 7								
Refinery 8					80000	51000	28000	gal
Refinery 9					10000		1500	gal
Refinery 10	3900	1880	820	lbs				
Refinery 11	150	100	50	lbs				
Refinery 12								
Refinery 13								
--- Chemical Plants:								
Chemical Plant 1								
Chemical Plant 2								
Chemical Plant 3								
Chemical Plant 4								
Chemical Plant 5					24000	16000	6000	gal
Chemical Plant 6	40	25	5	tons				
Chemical Plant 7					1800	900	450	lbs
Chemical Plant 8	1500	1000	500	lbs				
Chemical Plant 9	2000	1400	800	lbs				
Chemical Plant 10								
Chemical Plant 11								
Chemical Plant 12					500	300	150	gal
Chemical Plant 13	3000	2000	1700	lbs				
Chemical Plant 14					45840	22920	3820	lb (24 wt
Chemical Plant 15					7500	3000	0	gal
Chemical Plant 16					8000	5000	2000	gal
Chemical Plant 17					750	245	0	lbs
Chemical Plant 18					200	100	50	lb (28%)
Chemical Plant 19	7000	2000	100	???			6	
Chemical Plant 20	1000	<500	0	lbs				
Chemical Plant 21	1850	1000	740	lbs				
Chemical Plant 22	1800	1000	100	lbs				
Chemical Plant 23					100000	65000	20000	lb (28%)
Chemical Plant 24					1395	400	0	lbs
Chemical Plant 25	100	50	30	tons	45	25	7	tons
Chemical Plant 26					7000	7000	7000	gal
Chemical Plant 27					330	330	0	lbs
Chemical Plant 28	6000	3000	0	lbs				
Chemical Plant 29	3700	2000	0	lbs				
Chemical Plant 30	4500	3000	1350	lbs				
Chemical Plant 31	12000	6000	0	gal				
Chemical Plant 32					900	700	0	gal
Chemical Plant 33					2000	1000	500	gal (28%)
Chemical Plant 34								
Chemical Plant 35								
Chemical Plant 36								
Chemical Plant 37								

Company	Anhydrous Ammonia Maximum	Average	Minimum	Units	Aqueous Ammonia Maximum	Average	Minimum	Units
--- Chemical Packaging:								
Chem. Packaging 1								
Chem. Packaging 2								
Chem. Packaging 3	10200		1000	gal	5000			gal
Chem. Packaging 4	27000	18000	0	lbs				
Chem. Packaging 5								
Chem. Packaging 6								
Chem. Packaging 7	soln)							
--- Water Treatment:								
Water Treatment 1								
Water Treatment 2								
Water Treatment 3								
--- Misc.:								
Misc. 1	"Cylinder Quantities Only"							
Misc. 2								
Misc. 3								
Misc. 4	210	170	140	cu.ft.				
Misc. 5					5	1		gal
Misc. 6					12		2.5	liters
Misc. 7	20	12	4	lbs				
Misc. 8	???	???	???	???				
Misc. 9					7500	5000	2000	gal
Misc. 10	10200	4000	1800	gal				
Misc. 11								
--- Chemical Shipping:								
Chem. Shipping 1								

Company	Carbon Tetrachloride Maximum	Carbon Tetrachloride Average	Carbon Tetrachloride Minimum	Carbon Tetrachloride Units	Sulfur Dioxide Maximum	Sulfur Dioxide Average	Sulfur Dioxide Minimum	Sulfur Dioxide Units
--- Refineries:								
Refinery 1								
Refinery 2								
Refinery 3					11025	5000	0	lb/hr
Refinery 4								
Refinery 5								
Refinery 6								
Refinery 7								
Refinery 8					60000	19000	7000	cu.ft./hr
Refinery 9	800		100	gal	40000	30000	12000	scfh
Refinery 10					22000	12000	100	lbs
Refinery 11								
Refinery 12								
Refinery 13						40		mscfh
--- Chemical Plants:								
Chemical Plant 1	4	2	0	quarts				
Chemical Plant 2								
Chemical Plant 3								
Chemical Plant 4								
Chemical Plant 5					20000	10000	2000	gal
Chemical Plant 6								
Chemical Plant 7								
Chemical Plant 8								
Chemical Plant 9								
Chemical Plant 10								
Chemical Plant 11								
Chemical Plant 12								
Chemical Plant 13								
Chemical Plant 14					50000	35000	10000	lbs
Chemical Plant 15								
Chemical Plant 16								
Chemical Plant 17								
Chemical Plant 18								
Chemical Plant 19								
Chemical Plant 20								
Chemical Plant 21								
Chemical Plant 22								
Chemical Plant 23								
Chemical Plant 24								
Chemical Plant 25								
Chemical Plant 26								
Chemical Plant 27								
Chemical Plant 28								
Chemical Plant 29								
Chemical Plant 30								
Chemical Plant 31								
Chemical Plant 32								
Chemical Plant 33								
Chemical Plant 34	110	55	55	gal				
Chemical Plant 35	470	250	50	tons				
Chemical Plant 36					10000	50000	0	gal
Chemical Plant 37					850	700	0	lb

Company	Carbon Tetrachloride Maximum	 Average	 Minimum	 Units	Sulfur Dioxide Maximum	 Average	 Minimum	 Units
--- Chemical Packaging:								
Chem. Packaging 1								
Chem. Packaging 2								
Chem. Packaging 3								
Chem. Packaging 4					180000	80000	4000	lbs
Chem. Packaging 5								
Chem. Packaging 6								
Chem. Packaging 7								
--- Water Treatment:								
Water Treatment 1								
Water Treatment 2								
Water Treatment 3								
--- Misc.:								
Misc. 1					"Cylinder Quantities Only"			
Misc. 2	8	4	1	gal				
Misc. 3								
Misc. 4								
Misc. 5								
Misc. 6	4000		500	ml				
Misc. 7								
Misc. 8					???	???	???	???
Misc. 9								
Misc. 10								
Misc. 11					120000	65000	10000	lbs
--- Chemical Shipping:								
Chem. Shipping 1					200		50	tons

Company	Chloropicrin			
	Maximum	Average	Minimum	Units
--- Refineries:				
Refinery 1				
Refinery 2				
Refinery 3				
Refinery 4				
Refinery 5				
Refinery 6				
Refinery 7				
Refinery 8				
Refinery 9				
Refinery 10				
Refinery 11				
Refinery 12				
Refinery 13				
--- Chemical Plants:				
Chemical Plant 1				
Chemical Plant 2				
Chemical Plant 3				
Chemical Plant 4	150	75	10	tons
Chemical Plant 5				
Chemical Plant 6				
Chemical Plant 7				
Chemical Plant 8				
Chemical Plant 9				
Chemical Plant 10				
Chemical Plant 11				
Chemical Plant 12				
Chemical Plant 13				
Chemical Plant 14				
Chemical Plant 15				
Chemical Plant 16				
Chemical Plant 17				
Chemical Plant 18				
Chemical Plant 19				
Chemical Plant 20				
Chemical Plant 21				
Chemical Plant 22				
Chemical Plant 23				
Chemical Plant 24				
Chemical Plant 25				
Chemical Plant 26				
Chemical Plant 27				
Chemical Plant 28				
Chemical Plant 29				
Chemical Plant 30				
Chemical Plant 31				
Chemical Plant 32				
Chemical Plant 33				
Chemical Plant 34				
Chemical Plant 35				
Chemical Plant 36				
Chemical Plant 37				

	Chloropicrin			
Company	Maximum	Average	Minimum	Units
--- Chemical Packaging:				
Chem. Packaging 1				
Chem. Packaging 2				
Chem. Packaging 3				
Chem. Packaging 4				
Chem. Packaging 5				
Chem. Packaging 6				
Chem. Packaging 7				
--- Water Treatment:				
Water Treatment 1				
Water Treatment 2				
Water Treatment 3				
--- Misc.:				
Misc. 1				
Misc. 2				
Misc. 3				
Misc. 4				
Misc. 5				
Misc. 6				
Misc. 7				
Misc. 8				
Misc. 9				
Misc. 10				
Misc. 11				
--- Chemical Shipping:				
Chem. Shipping 1				

EXHIBIT D

EXAMPLE DRAFT RULE

EXHIBIT D

EXAMPLE DRAFT RULE

EXAMPLE OF
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT RULE
CONTROL OF TOXIC CHEMICAL RELEASES

(a) Purpose

The purpose of this rule is to prevent accidental releases of toxic chemicals, reduce the probability of accidental releases or reduce the consequences of accidental releases of toxic chemicals by requiring industry to anticipate circumstances that could result in their occurrence and take appropriate precautionary and preemptive actions.

(b) Applicability

(1) This rule applies to plants using, manufacturing, storing, handling, or generating at any time the following designated chemicals in quantities equal to or exceeding the specified threshold amounts: anhydrous ammonia (to be determined by SCAQMD) CAS No. 7664-41-7; carbon tetrachloride (to be determined by SCAQMD) CAS No. 56-23-5; gaseous or liquid chlorine (to be determined by SCAQMD) CAS No. 7782-50-5; chloropicrin (to be determined by SCAQMD) CAS No. 76-06-2; hydrogen cyanide, CAS No. 74-90-8, and its metal salts as solids or in solution (to be determined by SCAQMD); anhydrous hydrogen fluoride (to be determined by SCAQMD) CAS No. 7664-39-3; and anhydrous sulfur dioxide (to be determined by SCAQMD) CAS No. 7446-09-5. For the purpose of determining applicability, the threshold quantities shall include the total inventory (maximum at any one time within the last 12 months or maximum capacity) of the designated chemical in-process or in storage within the designated plant boundaries, and applies to mixtures of the designated chemicals and other chemicals when the concentration of the designated chemical is at least 80 percent by weight or greater.

(2) Vehicular storage shall be subject only to the registration and release reporting requirements contained in Sections (d) and (h) of this rule.

(c) Definitions

For the purposes of this rule, the following definitions shall apply:

(1) All definitions stated in Regulation I, Rule 102.

(2) "Accidental release" means the spilling, leaking, pumping, purging, emitting, emptying, discharging, escaping, dumping, or disposing into the environment during any one-hour period of a designated chemical which can result in release to the atmosphere in a quantity

equal to or exceeding the following amount: anhydrous ammonia (to be determined by SCAQMD); carbon tetrachloride (to be determined by SCAQMD); gaseous or liquid chlorine (to be determined by SCAQMD); chloropicrin (to be determined by SCAQMD); hydrogen cyanide and its metal salts as solids or in solution (to be determined by SCAQMD); anhydrous hydrogen fluoride (to be determined by SCAQMD); and anhydrous sulfur dioxide (to be determined by SCAQMD). Accidental releases shall not include emissions and discharges of designated chemicals in compliance with the plant's federal, state, or local environmental permits.

(3) "Accidental Release Control Plan" means a written program prepared by the owner/operator of a designated plant describing all of the risk reduction measures used to prevent or minimize the probability of and consequences of accidental releases of designated chemicals.

(4) "Designated chemical" means anhydrous ammonia (CAS No. 7664-41-7), carbon tetrachloride (CAS No. 56-23-5), gaseous or liquid chlorine (CAS No. 7782-50-5), chloropicrin (CAS No. 76-06-2), hydrogen cyanide (CAS No. 74-90-8) and its metal salts as solids or in solution, anhydrous hydrogen fluoride (CAS No. 7664-39-3), and anhydrous sulfur dioxide (CAS No. 7446-09-5).

(5) "Designated plant" means any facility using, manufacturing, storing, handling, or generating a designated chemical in quantities exceeding the threshold amounts specified in Section (b) above. A designated plant includes all buildings, equipment, and contiguous areas at a single location under the ownership or control of the same person.

(6) "Equipment controls" means any process, storage, or handling equipment or equipment design practices used at a designated plant for reduction of hazardous release risks. These include prevention controls which are process design and operational controls that reduce the probability of a release and protection controls which destroy or remove the designated chemical from the potentially released process material.

(7) "Executive Summary" means a summary of an accidental release control plan or risk reduction plan that provides sufficient information for the Executive Officer of the District to make a decision that the plans summarized are adequate or determine if more information is required.

(8) "Hazard" means an intrinsic property of a material, operation, or piece of equipment that causes it to represent a foreseeable danger (e.g., toxicity and flammability are hazardous properties of H_2S).

(9) "Hazard evaluation" means the process of identifying potential hazardous events that could result in an accidental release, evaluating the probability of an occurrence (either qualitatively or quantitatively), and estimating the potential impacts of the release.

(10) "Hazardous release risk" means a potential for the accidental release of a designated chemical into the environment which could produce a significant likelihood that persons exposed may suffer acute or irreparable health effects resulting in significant injury or death.

(11) "Inventory" means the maximum amount of the designated chemical on-site at any one time, including stored and in-process materials, and excluding mixtures of the designated chemicals and other chemicals where the concentration of designated chemical is 80 percent or greater by weight.

(12) "Layout control" means the spacing and arrangement of buildings, equipment, and contiguous areas at a designated plant which reduce hazardous release risks.

(13) "Management control" means any administrative measure used at a designated plant for reduction of hazardous release risks. Administrative measures include, but are not limited to, maintenance, operator training, accident investigation, emergency response, and internal/external audit programs.

(14) "Operational control" means an operational program or practice used at a designated plant for reduction of hazardous release risks. Operational controls include, but are not limited to, chemical compatibility assurance, materials handling, and waste management practices.

(15) "Risk" means the potential consequences weighted by the probability of occurrence (i.e., risk = probability x consequences).

(16) "Risk reduction" means the use of siting, layout, process, equipment, operational, and/or management controls to prevent or minimize the consequences of accidental releases for human health and the environment.

(17) "Risk Reduction Plan" means a written remedial action program prepared by the owner/operator of a designated plant describing the measures which will be taken to correct deficiencies identified by the District in the plant's Accidental Release Control Plan.

(18) "Siting control" means measures taken to locate a designated plant in a manner which reduces hazardous release risks or to consider such siting in other aspects of accidental release control.

(19) "Vehicular storage" means vehicles such as tank cars or tank trailers while stationary on the plant property and that are used for storage of designated chemicals.

(d) Registration

The owner/operator of any plant manufacturing, using, storing, handling, or generating a designated chemical shall register with the District by completing and submitting the registration form provided in Appendix A to this rule.

(e) Accidental Release Control Plan

(1) Plan Requirements

The owner/operator of a designated plant shall submit for approval of the Executive Officer of the District an executive summary of a plan for controlling hazardous release risks from the designated chemicals. The intent of the summary is to highlight major provisions of the Accidental Release Control Plan at the plant. In preparing a Accidental Release Control Plan for a designated plant, the owner/operator should consider the control criteria listed in Section (g). The Accidental Release Control Plan for a designated plant should provide sufficient detail to allow the District to determine in a reasonable amount of time whether the risks of accidental release are adequately controlled. The appropriate level of detail for a Plan will vary with the potential risks associated with the plant. Detailed data supporting the Accidental Release Control Plan should be maintained at the plant during its operating life. An executive summary of the Accidental Release Control Plan should be conceptual in nature, with sufficient detail to allow meaningful evaluation.

The following elements which should be provided in the executive summary: (A) present inventory of designated chemicals and quantities produced, stored, or handled monthly; (B) summary descriptions of processes and principal equipment involved in handling designated chemicals; (C) description of the area in which the designated plant is situated including its proximity to water supplies and populated areas; (D) description of the extent to which the hazardous release risks of the processes, equipment, operations, and management have been identified, evaluated, and controlled; (E) expertise and affiliation of the evaluators of the plant's handling of designated chemicals; (F) summary description of the recordkeeping system of the designated plant; (G) summary description of the safety maintenance schedule for equipment and processes involving the designated chemicals; (H) summary description of the plant's risk management program; (I) summary description of safety review and design procedures for new and existing equipment; (J) summary description of standard operating procedures; (K) summary description of the accidental release related preventive maintenance program; (L) summary description of operator training and accident investigation procedures; (M) summary description of hazard evaluation procedures for specific pieces of equipment or operating alternatives (examples of some acceptable methodologies are given in Appendix B); (N) summary description of emergency response planning; and (O) summary description of internal or external audit procedures.

(2) Variances

The owner/operator of a designated plant may apply to the Executive Officer of the District for a variance from some of the requirements for a Accidental Release Control Plan listed in Subsection (1) above. A variance may be granted by the Executive Officer of the District upon written finding that a certain requirement is not justified on the basis of the hazardous release risks associated with the plant. The burden-of-proof shall be on the plant owner/operator to demonstrate the basis for variance.

(3) Action on Plans and Variances

The Executive Officer of the District shall act, within a reasonable time, on a Risk Control Plan or variance and shall notify the owner/operator in writing of the approval or disapproval. Before disapproving a Risk Control Plan or variance request, the Executive Officer of the District shall allow an owner/operator 30 days to correct deficiencies, subject to a reasonable extension for good cause.

(f) Risk Reduction Plan

If a Risk Control Plan for a designated plant is disapproved by Executive Officer of the District, the owner/operator shall prepare and submit a Risk Reduction Plan for Executive Officer of the District approval which addresses unresolved deficiencies in the Accidental Release Control Plan. The Risk Reduction Plan shall consist of the following elements: (1) owner/operator identification; (2) identification and quantity of designated chemicals that could be released in the event of an equipment breakdown, human error, design defect, procedural failure, or imposition of an external force; (3) information concerning the nature, age, and condition of all equipment involved in the handling and management of the designated chemicals and their testing/maintenance schedules; (4) remaining deficiencies identified by the owner/operator or Executive Officer in the operation of the plant which represent a hazardous release risk; (5) recommended or required practices, procedures, and equipment designed to correct deficiencies by preventing or reducing the probability of hazardous release risks; (6) recommended or required training or management practices to inform the relevant plant personnel regarding the dangers posed by potential releases; and (7) recommended or required schedule for implementation of the Risk Reduction Plan.

(g) Control Considerations

In preparing a Accidental Release Control Plan or Risk Reduction Plan for a designated plant as required by Sections (e) and (f) of this Rule, an owner/operator should consider siting, layout, equipment, operational, and management controls needed to reduce hazardous release risks associated with plant operations. Examples of control criteria that should be considered are described in Appendix C. The control criteria do not supercede standards, specifications, or requirements of other regulatory agencies applicable to the elements addressed.

(h) Recordkeeping and Reporting

(1) Recordkeeping -- The owner/operator of a designated plant shall maintain at the designated plant at least the following records pertaining to hazardous release control and reduction: (A) approved Accidental Release Control and Risk Reduction Plans where applicable; (B) written descriptions of risk assessment and reduction efforts undertaken; (C) records of required operator training provided specific to facilities for designated chemicals; (D) preventive maintenance and inspection records for facilities specific to designated chemicals; and (E) reports of accidental releases of designated chemicals. The records shall be retained for at least five years.

(2) Reportable Releases -- The owner/operator of a designated plant shall report to the District any accidental releases of designated chemicals, according to the definition of accidental release in Section (c)(2). The report shall be made by telephone to the District offices (time period to be determined by SCAQMD). The report shall include a description of the nature and extent of the release, persons potentially affected, and response actions undertaken. A written report of the release shall be submitted to the District within seven days of the release.

(i) Compliance Schedule

The owner/operator of a designated plant shall comply with the requirements of this rule according to the following schedule: (1) registration form submission -- within a time period of the effective date of this rule to be determined by the District; (2) Accidental Release Control Plan submission -- to be determined by the District on a case-by-case basis and (3) Risk Reduction Plan submission -- to be determined by the District on a case-by-case basis after Executive Officer disapproval of the Accidental Release Control Plan.

Submission deadlines may be extended for good cause by the Executive Officer of the District upon demonstration of need by the owner/operator.

(j) Plan Amendments, Approval Transferability, and Plant Closure

(1) Plan Amendments

The owner/operator of a designated plant shall submit all proposed amendments for changes and modifications to approved Accidental Release Control and Risk Reduction Plans for the review and approval of the Executive Officer of the District with a specified time period to be determined by the District on a case-by-case basis. Plant modifications requiring amendments to the plan are to be determined by the District.

Recertification of the Plan is required every two years. Recertification requires a statement that there have been no changes in the plant that require changes in the plan.

An updated Accidental Release Control Plan shall be submitted periodically within an interval of years to be determined by the District on a case-by-case basis.

(2) Transferability and Plant Closure

Approvals of Accidental Release Control and Risk Reduction Plans shall not be transferable, whether by operation of law or otherwise, either from one location to another or from one person to another. When a designated plant is permanently closed, changes ownership, or will no longer be operated by the owner/operator which registered the plant, the Accidental Release Control Plan and Risk Reduction Plan approvals shall become void. Such Plans must be resubmitted by the new ownership in accordancd with provisions of Section (i) of this rule. The new owners must abide by provisions of the old Plan until the new Plan is approved. For the purposes of this rule, statutory mergers, name changes, or incorporations by an individual owner or partnership composed of individuals shall not constitute a transfer or change of ownership.

(1) Severability

If any portion of this rule shall be found to be unenforceable, such finding shall have no effect on the enforceability of the remaining parts of the rule, which shall continue to be in full force and effect.

APPENDIX A

Registration Form

SOUTH COAST AIR QUALITY MAINTENANCE DISTRICT
CONTROL OF TOXIC CHEMICAL RELEASES

Page 1

REGISTRATION FORM INVENTORY

SECTION A

1. Facility Name (Full Business Name) ____________________
2. Nature of Business: ____________________
3. SIC Code ____________ Plant I.D. No. ____________
4. Facility Location: ____________________
No. Street
____
City County State Zip
____
Lot No. Block No.
5. Facility Mailing Address: ____________________
No. Street
____
City County State Zip
6. Name of Contact: ____________ Telephone ( ) ____________
7. Title: ____________________

SECTION B

Does this facility use, manufacture, store, handle, or generate any of the following designated chemicals as a raw material, intermediate, final product, by-product, or waste product in an amount equal to or in excess of the following listed quantities: anhydydrous ammonia (to be determined by SCAQMD) CAS No. 7664-41-7; carbon tetrachloride (to be determined by SCAQMD) CAS No. 56-23-5; elemental chlorine (to be determined by SCAQMD) CAS No. 7782-50-5; chloropricin (to be determined by SCAQMD) CAS No. 76-06-2; hydrogen cyanide, CAS No. 74-90-8, and its metal salts as solids or in solution (to be determined by SCAQMD); anhydrous hydrogen fluoride (to be determined by SCAQMD) CAS No. 7664-39-3; and anhydrous sulfur dioxide (to be determined by SCAQMD) CAS No. 7446-09-5.

/ / Yes / / No

If "No", sign the certification below and fill out the registration form Section D only. If "Yes", complete the remaining sections of the registration form before signing the certification below.

SECTION C - **Certification of Facility Manager**

I hereby certify that all information regarding this registration form is true, complete, and correct to the best of my knowledge. I am aware that if any of the information provided in this registration form is willfully false, I am subject to punishment, including fines and/or imprisonment.

Signature: ____________________ Date ____________
Name (Print): ____________________ Title: ____________

Mail Completed Registration Forms to:

South Coast Air Quality Management District
Engineering Division
9150 Flair Avenue
El Monte, CA 91731
Attn:

For assistance or additional information, call: (818) 572-6200.

REGISTRATION FORM

Page 2

SECTION D

Make additional copies of this page if necessary.

INVENTORY - Complete the following table for every designated chemical used,manufactured, stored, handled, or generated at this facility. Use the codes indicated below.

				Quantities Stored (pounds)			Quantities In-Process (pounds)			
Designated Chemical	CAS No.	Form	Use	Avg	Max	Cap	Avg	Max	Cap	Comments
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										

Codes

Form
L-Liquid
G-Gas
S-Solid

Use
RM-Raw Material
I-Intermediate
F-Final Product
BP-By-Product
WP-Waste Product
O-Other (describe)

Quantites Stored and Quantities In-Process
Average-Monthly Average
Maximum-Monthly Maximum
Capacity-Maximum Capacity

SECTION E

Complete this section for each designated chemical listed in Section D. Make additional copies of this page if necessary.

1. Indicate the designated chemical for which the following process description and equipment list applies: ________________________________

2. Process Description - Provide a general description of the process involved in the use, manufacture, storage, handling, or generation of the designated chemical. Indicate typical and maximum operating conditions (i.e., temperatures and pressures) as they relate to the designated chemical. Provide simplified process flow sheets and a plot plan if available.

APPENDIX B

Hazard Evaluation Methodologies

In evaluating the hazardous release risks associated with processes, equipment, and procedures, the owner/operator of a designated plant should consider using one or more of the following methodologies, as appropriate: (A) process/system checklists; (B) safety review; (C) relative ranking -- Dow and Mond Hazard Indices; (D) preliminary hazard analysis; (E) "What If" analysis; (F) hazard and operability (HazOp) studies; (G) failure modes, effects, and criticality analysis; (H) fault tree analysis; (I) event tree analysis; (J) cause-consequence analysis; and (K) human error analysis. An owner/operator may use another equivalent hazard evaluation methodology in assessing hazardous release risks, but should provide an equivalency demonstration in the Accidental Release Control Plan.

APPENDIX C

Control Considerations

The control considerations listed here are examples of criteria that should be considered in Accidental Release Control Plans. These examples are not necessarily complete, nor are all items necessarily applicable to all facilities, and are intended as guidance for preparation of the Control Plan.

(1) Siting and Layout Controls

(A) Siting -- The impact of a plant's location on the frequency or severity of an accidental release should be evaluated and steps taken to minimize potential impacts. Siting considerations include, but are not limited to, the following: (i) drainage systems should prevent the runoff of spilled liquid chemicals onto adjacent properties and prevent the spread of toxic and/or flammable liquid chemicals in a manner that minimizes adverse impacts within and outside of the plant boundaries; (ii) equipment design should be appropriate to minimize the effects of natural calamities such as freezing, fire, floods, earthquakes, and landslides in contributing to an accidental release; (iii) the potential impact of accidents such as fires, explosions, or hazardous chemical releases at adjacent industrial facilities, roads, or railways should be considered and minimized by appropriate design and operating procedures; and (iv) reliable water and power supplies should be available with backups where a failure could cause an accidental chemical release; and (v) traffic flow patterns within the plant and around the perimeter should be designed to prevent congestion and allow access by emergency response vehicles and appropriate movement of personnel in an emergency.

(B) Layout -- The layout of a plant should contribute to safe operations, be consistent with safety practices customary in the industry, and reduce the potential for and impacts of an accidental release. Layout considerations include, but are not limited to, the following: (i) process units and the equipment and piping within a unit should be arranged to prevent unnecessary congestion; (ii) where possible, hazardous processes should be segregated from other hazardous processes or sensitive areas within the plant or plant property; (iii) adequate spacing should be available for access by maintenance and emergency response personnel and equipment; (iv) explosion barriers should be applied where appropriate; (v) escape routes for personnel should be easily accessible; and (vi) offices, lunchrooms, or other support structures should be located at the perimeter of the facility.

(2) Process Controls

(A) Chemical Processes -- The design of a process in which designated chemicals are used or produced should be based on sufficient data to ensure a safe operating system. Necessary data to be considered in the design process includes, but is not limited to, the following: (i) chemical, physical, and toxicological properties of the individual chemical components used or produced in the process; (ii) the process potential for explosive reaction or detonation under normal or abnormal conditions; (iii) process reactivity with water or other common contaminants; (iv) possibility of spontaneous polymerization or heating; (v) potential side reactions and conditions under which they are favored; (vi) whether reactions are endothermic, exothermic, or thermodynamically balanced; (vii) the explosive range of volatile or gaseous components and the possibility of explosive mixtures during storage, processing, or handling; and (viii) the possibility of dust or mist explosions; and (ix) interactions with materials of construction.

(B) Chemical Storage — The design of storage facilities for designated chemicals should have considered the same data as for process facilities, and should also have considered the effects of materials transfer, the possibility of incorrect transfer, and large inventories.

(3) Equipment Controls

(A) Foundations — Foundations should assure the stability of all vessels and nontransportable equipment containing designated chemicals. The design should be in accordance with recognized construction and material specification standards in the industry, as a minimum. The design should consider all normal and abnormal load and vibration conditions as well as severe conditions caused by freezing, fire, wind, earthquakes, flood, or landslides. Transportable equipment should be secured to prevent upset or accidental detachment of process lines conveying designated chemicals during use and should not be used to permanently replace a stationary piece of equipment unless standard safety practice dictates a preference or requirement for such transportable equipment.

(B) Structural Steel — Structural steel should, as a minimum, be designed and constructed in accordance with appropriate construction and material specification standards in the industry. The design should consider all normal and abnormal dead loads and dynamic loads resulting from wind, collision, earthquake, or other external forces. At minimum, fireproofing should be used for areas in which designated chemicals are mainufactured, stored, handled, or generated and such areas should conform with legally applicable codes and standards. More protection should be considered for hazardous areas in which designated chemicals are present.

(C) Vessels -- Vessel design and construction should conform to recognized design and material standards for the specific application in the industry. Stricter standards and specifications may sometimes be appropriate. Design should consider the most severe combination of conditions anticipated for quantity, fill rate, pressure, temperature, reactivity, toxicity, and corrosivity. As a minimum, all vessels should be equipped with the following safety features: (i) overfill and overpressure protection should be provided and, where appropriate, vacuum protection; (ii) storage vessels should be surrounded by diking, firewalls, or other containment devices unless such features are deemed to create a more severe secondary hazard; (iii) vessels and vessel fittings should be protected from damage caused by collision or vibration and should be adequately braced to support the weight of piping. Columns should be adequately supported to withstand the maximum wind loads expected in the area; and (iv) operators should be trained concerning the vessel's limits for pressure, temperature, fill and emptying rates, and incompatible materials.

Additional items such as nitrogen blanketing, improved fire protection, or release reduction equipment (e.g., water or steam curtains) will be appropriate in certain situations.

(D) Pressure and Vacuum Relief Systems -- All pressure vessels and vessel jackets should be fitted with adequate pressure and/or vacuum relief. The relief systems should be designed according to recognized design procedures and standards appropriate in the industry as a minimum. Stricter procedures and standards may sometimes be appropriate. Containment systems should be designed according to recognized design procedures for containment systems. Valves upstream of pressure or vacuum relief devices should be prevented from being closed in such a way that the vessel will be isolated from all pressure relief or vacuum relief. Where possible, a pressure trip system should be used along with a pressure relief system. This will help to minimize the frequency of releases of designated chemicals through the pressure relief system. All pressure or vacuum relief devices should be inspected and maintained on a regular basis. The adequacy of a pressure or vacuum relief system should be reevaluated when a vessel or process unit is used to handle more material, or a different material, than that for which it was originally designed.

(E) Pumps and Compressors -- Extra precautions should be taken in the design of pumps and compressors to minimize the potential for an accidental release of a designated chemical. Extra precautions include, but are not limited to, the following: (i) where a pressurized hazardous material is being pumped or where the consequence of a seal failure could result in the accidental release of designated chemical, seals should be suitable to ensure reliable leak prevention (e.g., double mechanical seal with a pressurized barrier fluid); (ii) totally enclosed pump or compressor systems may be appropriate, if safely vented and inerted and monitored for oxygen where enclosure could result in a secondary hazard such as an explosive mixture; (iii) remotely operated emergency isolation valves and power shutoff switches may be appropriate on the suction and discharge sides of a pump or compressor; (iv) compressors or positive displacement pumps should be fitted with adequate overpressure protection; (v) instrumentation to determine when flow into or out of a pump has ceased may be appropriate; (vi) where overheating could result in a fire or explosion, temperature monitoring may be appropriate; (vii) a backup power supply should be used for critical pumping systems; and (viii) pumps, compressors, and their associated piping should have foundations and supports that protect against damage caused by vibration and any static and dynamic loads.

(F) Heaters and Furnaces -- Heaters and furnaces should be located so as to minimize the possibility of bringing an open flame and/or extreme heat too close to a hazardous area. Basic units and controls should be designed in accordance with applicable standards and codes as a minimum. Stricter standards may sometimes be appropriate. Examples of some of the basic requirements for furnaces include the following: (i) provision for adequate draft; (ii) positive fuel ignition; (iii) automatic water level controls; (iv) pressure relief devices; and (v) fuel controls. Air heaters should have igniters designed to provide positive ignition, proper safety controls on fuel sources, sight glasses for flame observation, monitoring devices for flame-out detection, and high temperature alarms. All heaters and furnaces should be inspected on a regular basis. Where heaters and furnaces handle hazardous process materials, appropriate precautions should be taken to prevent releases in the event of tube failures, such as cracking, rupture, or plugging.

(G) Heat Exchangers -- At minimum, heat exchangers should be constructed in accordance with accepted industry codes and standards. Stricter standards may sometimes be appropriate. The materials of construction should be selected to minimize corrosion and fouling. All exchangers should be equipped with pressure relief, by-pass piping, and adequate drainage facilities. Exchanger design should allow for thermal expansion and construction without causing excessive stress on connections.

(H) Turbines -- Turbines, drivers, and auxiliary machinery should be designed, constructed, and operated in accordance with applicable industry standards and codes. Stricter controls may sometimes be appropriate. The equipment should have adequate protective devices to shut down the operation and/or inform the operator before danger occurs.

(I) Electrical Equipment -- All wiring and electrical equipment should be installed in accordance with the National Electric Code or stricter standards, if applicable. Electrical equipment for use in hazardous locations should comply with acceptability criteria of recognized testing organizations. All electrical apparatus should be grounded where appropriate.

(J) Instrumentation -- Every reasonable effort should be made to maximize the effectiveness of automatic process control systems for the preventing of an accidental release. All systems and instrumentation should be of the "fail-safe" type. Instruments should be made of materials capable of withstanding the corrosive or erosive conditions to which they are subjected. Central control rooms should be protected from fire and explosion hazards. An owner-operator should evaluate the ability of control systems to operate on manual control and should install a backup power supply in situations where operating on manual control would be impractical.

A variety of miscellaneous modifications may be appropriate, depending upon the needs of the particular process unit. Examples of these modifications include, but are not limited to the following: (i) the addition of control systems where none are presently employed; (ii) redundancy of key components; (iii) replacing components to improve accuracy, reliability, repeatability, or response time; (iv) the addition of a backup control system; (v) simplification of an existing control system to improve operability; (vi) replacing a system that indirectly controls the variable of interest with a system that directly measures and controls the variable of interest; (vii) the addition of trip systems for emergency situations; and (viii) the redesign of a control system to conform to acceptable design standards.

(K) Piping -- As a minimum, piping, valves, and fittings should be designed according to recognized industry codes and standards pertaining to working pressures, structural stresses, and corrosive materials to which they may be subjected. The thermal stress of repeated heating and cooling cycles or excessive temperatures, either high or low, should be considered. Some additional considerations include, but are not limited to, the following: (i) dead ends or unnecessary and rarely used piping branches should be avoided; (ii) the type of pipe appropriate for pumping a designated chemical should be selected (e.g., using welded or flanged pipe instead of threaded pipe or using a suitable metal or lined metal piping instead of plastic wall piping); (iii) backflow protection should be installed where necessary, but backflow prevention should not be relied upon as the only means of avoiding a backflow hazard; (iv) materials of construction suitable for the application should be selected; and checked before installation to confirm the composition; (v) recordkeeping or critical lines should be provided to prevent incorrect future substitutions; (vi) a means of remotely shutting off the flow in lines that carry a large volume of hazardous materials should be provided; (vii) adequate structural support should be provided to protect against vibration and loads and to protect piping from potential collisions; (viii) piping should be pitched to avoid unintentional trapping of liquids; and (ix) provisions should be made to ensure that a liquid-full condition cannot exist in a blocked section of line unless such a section of line has pressure relief.

(L) Emissions Control Devices -- Emission control devices should have the capability of warning operating personnel when emissions are not being controlled. If a device is only used on an intermittent basis, then a testing program should be in place to ensure that the system will function when necessary.

(M) Fire Protection and Safety -- As a minimum, plant fire protection systems should be laid out in accordance with recognized codes and standards, such as those prepared by the National Fire Protection Association. A reliable water supply for all portions of the plant should be available. Flammable gas detection systems are recommended for locations where flammable chemicals are used at elevated temperatures and pressures. Central fire alarm systems should be in place. In addition to water, firefighting materials -- such as spray foams, dry chemicals, and carbon dioxide -- should be available, as appropriate, to handle various specialized types of fires.

(4) Operational Controls

(A) Chemical Compatibility -- The following types of reactive materials should be stored so that the potential for mixing in the event of an accidental release is minimized by dikes or other physical barriers: (i) materials that react to form a designated chemical; (ii) designated chemicals that react exothermically and thereby contribute to the rate of evaporation in the chemicals; and (iii) designated chemicals that will react such that the reaction will contribute to the potential for an accidental release.

Extra precautions may be required where there is a potential for mixing two incompatible chemicals within a process. Such precautions could include backflow protection, composition monitoring, and interlocks that prevent valves from being opened in combinations that allow for cross-contamination. Use of common lines for handling such incompatible chemicals should be avoided.

All materials of construction should be capable of withstanding normal operating conditions and normal shutdown conditions. Where a specialized material is required, then initial construction materials and replacement parts should be tested before use to ensure that the composition is consistent with specifications.

(B) Materials Handling -- Safe procedures should be established to minimize the risk of an accidental release of a hazardous material during filling or emptying operations for tanks, vessels, tank trucks, or tank cars. Some considerations include, but are not limited to, the following: (i) before material is added to a vessel, tank, tank truck, or tank car, the operator in charge of the addition should be able to verify what material is in the vessel or was last in the vessel; (ii) where hoses are used, a system should be in place to ensure that the proper type of hose is used for each application (e.g., different types of fittings for each application); (iii) hoses should be regularly inspected and maintained as necessary; (iv) efforts should be made to minimize the potential for materials to be sent to the wrong location; (v) a system should be in place to prevent tank trucks or rail cars from moving away with a hose still connected; (vi) when a hose is used to transfer materials, it should be possible to stop the flow if the hose should fail; (vii) equipment should be grounded and operators trained as to the appropriate methods for chemical transfer so as to avoid static charge accumulation.

(C) Waste Management Practices -- Procedures and equipment should be in place so that every reasonable effort may be made to prevent an accidental release from the storage, handling, or treatment of wastes containing the designated chemicals.

(5) Management Controls

(A) Operator Practices and Training -- Programs to train operators to handle normal operating conditions, upset conditions, emergency conditions, and accidental releases should be implemented. The programs should include written instruction, classroom instruction, and field drills. Periodic review and drill exercises should be part of such programs. Printed materials describing standard and emergency procedures should be provided to employees and revised as necessary to be consistent with accepted practices and recent plant modifications.

(B) Fire Protection and Prevention -- A plant-wide fire prevention and protection plan should be implemented. Every employee should be instructed concerning fire prevention and fire response. All plant personnel should be instructed in basic first aid and fire extinguisher use. The formation and training of specialized fire fighting teams and first aid teams should be in accordance with or exceed requirements of all fire protection and prevention plans should be periodically reviewed and drilled.

(C) Contingency Plan and Emergency Response Coordination -- The owner/operator of a designated plant should formulate a comprehensive contingency plan to handle major plant disasters. All plant personnel should be trained to participate in plans for controlling plant emergencies related to accidental releases including emergencies such as large windstorms, earthquakes, floods, power failure, fires, explosions, and accidental releases of designated chemicals.

The contingency plan should describe coordination between the plant and local police, fire, and other emergency personnel. The plan should be specific in designating responsibilities and in addressing specific high-hazard situations that are possible for the plant. Communications responsibilities and procedures for relaying information during emergencies should also be clearly defined. The plan should include procedures for emergency notification of community and local governments. Where an accidental release could adversely affect the local community, the plan should include appropriate community emergency response procedures.

Simulated emergency drills involving plant personnel should be performed on a regular basis. Disaster drills that incorporate local emergency response organizations should also be undertaken periodically.

(D) Maintenance -- An inspection, testing, and monitoring program for process equipment and instrumentation should be considered for areas of high hazard potential. Systems and components to which this program can be applied include, but are not limited to, the following: (i) pressure vessels; (ii) relief devices and systems; (iii) critical process instruments; (iv) process safety interlocks (trips); (v) isolation, dump, and drowning valves; (vi) process piping systems; (vii) electrical grounding and bonding systems; (viii) fire protection systems; and (ix) emergency alarm and communications systems. Engineering drawings and design specifications should be available for inspection, if requested.

Maintenance staff qualifications, skill level, and numbers should be consistent with the hazard potential at the specific operation.

A process safety review consistent with the magnitude of the modification should be made prior to the implementation of any modification. Documentation of modifications should be made and available for inspection, if required.

EXHIBIT E

PRELIMINARY TABLE OF CONTENTS FOR PREVENTION REFERENCE MANUALS

PRELIMINARY TABLES OF CONTENTS FOR PREVENTION REFERENCE MANUALS

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